



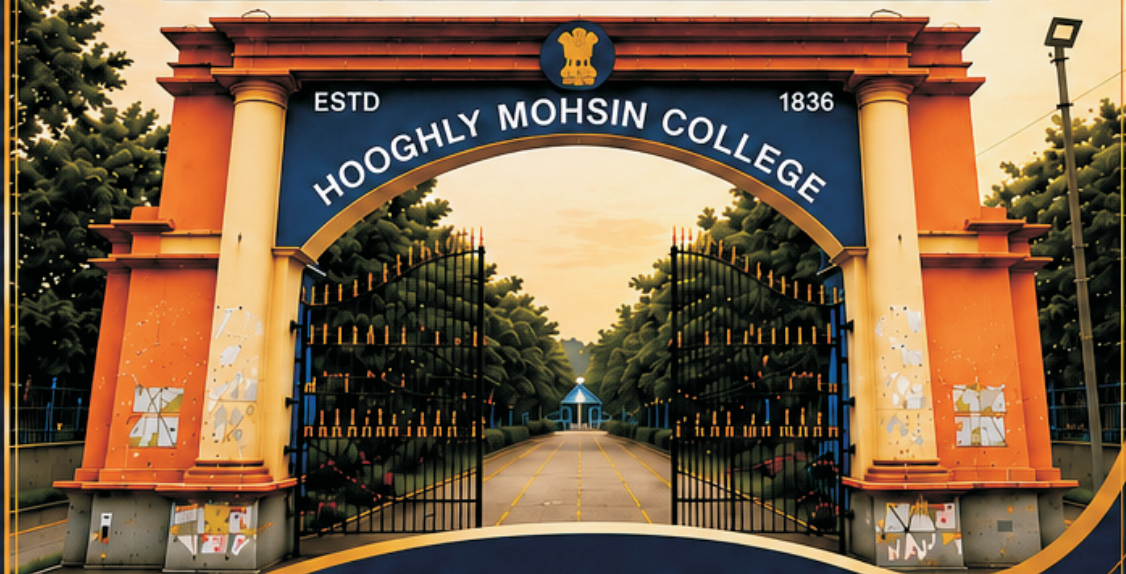
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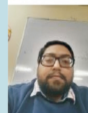
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The Editorial Board places on record its deep appreciation for their dedication, professionalism, and commitment to maintaining high academic standards. Their collective effort has been instrumental in the successful publication of the journal.

NOTE FROM THE EDITOR-IN-CHIEF

It gives me immense pleasure to present Volume 13, Issues 3 & 4 of the Academic Journal of Hooghly Mohsin College (AJHMC). As a peer-reviewed, multidisciplinary and multilingual journal, AJHMC remains dedicated to promoting quality research and providing a vibrant platform for the dissemination of original scholarly work across diverse academic disciplines.

The present volume reflects the commitment of researchers and academicians towards advancing knowledge through innovative research, critical analysis and interdisciplinary perspectives.

In an era where knowledge transcends disciplinary boundaries, academic journals play a crucial role in fostering intellectual exchange and collaborative research. We believe that the contributions published in this volume will enrich the existing body of knowledge and encourage further research in Science, Humanities, Commerce and other interdisciplinary domains.

I express my sincere gratitude to all the authors for choosing AJHMC as the platform for disseminating their research. My heartfelt appreciation also goes to our esteemed reviewers and Editorial Board members for their valuable time, constructive suggestions and unwavering commitment to maintaining the academic standards of the journal.

I hope that this issue will prove to be a valuable resource for researchers, academicians, students and policymakers, and will continue to strengthen the culture of quality research and academic excellence.

With best wishes,

Dr. Purushottam Pramanik, Principal
Editor-in-Chief

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NOTE FROM THE EDITOR

It is with great pleasure that we present Volume 13, Issues 3 & 4 of the Academic Journal of Hooghly Mohsin College (AJHMC). As a peer-reviewed, multidisciplinary and multilingual journal, AJHMC is committed to promoting high-quality scholarly research and fostering academic excellence across all disciplines.

This issue brings together original research papers and review articles contributed by researchers and academicians representing various fields, including Science, Humanities, Commerce, Social Science and interdisciplinary studies. The Editorial Board has ensured a rigorous peer-review process to maintain the quality, originality and academic integrity of every published manuscript.

We sincerely thank all the authors for their valuable contributions, the reviewers for their meticulous evaluation, and the members of the Editorial Board for their dedication and support in bringing out this issue successfully. We are also grateful to the Principal, Coordinator of IQAC, Secretary of Teachers' counsel, faculty members and the administration of Hooghly Mohsin College for their constant encouragement and cooperation.

We hope this volume will serve as a valuable academic resource for researchers, teachers, students and readers, while inspiring further research and scholarly dialogue.

With best wishes,

Dr. Atanu Saha
Editor

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NaSICON-Type Solid Electrolytes: High-Conductivity Frameworks for Next-Generation Sodium Batteries

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Abstract: The growing demand for safe, high-energy-density energy storage has accelerated the development of room-temperature solid-state sodium batteries (SSSBs) as cost-effective alternatives to lithium-ion batteries. Among solid electrolytes, NaSICONs ($\text{Na}_{1+x}\text{Zr}_2\text{Si}_x\text{P}_{3-x}\text{O}_{12}$) are particularly promising due to their high ionic conductivity, chemical stability, and robust mechanical properties. This review summarizes recent advances in NaSICON electrolytes, focusing on their crystal structure, sodium-ion transport, compositional optimization, doping, synthesis, and interfacial engineering. It critically examines the relationships between crystal chemistry, microstructure, ionic conductivity, and electrochemical performance, highlighting challenges such as grain-boundary resistance, densification, and interfacial stability. Computational studies, including Density Functional Theory (DFT) and Molecular Dynamics (MD), are also discussed alongside experimental findings. Finally, the review outlines key challenges and future research directions for advancing NaSICON electrolytes toward the commercialization of solid-state sodium batteries.

1. Introduction

The global transition toward decarbonization and renewable energy integration has intensified the need for advanced electrochemical energy-storage technologies. Although lithium-ion batteries (LIBs) dominate portable electronics and electric

vehicles owing to their high energy density and long cycle life, concerns over limited lithium resources, rising costs, uneven geographical distribution, and safety risks associated with flammable liquid electrolytes have accelerated the search for alternative battery chemistries. Among these, sodium-ion batteries (SIBs) are particularly attractive because sodium is inexpensive, abundant, and widely available. Moreover, sodium possesses an electrochemical potential close to that of lithium, enabling competitive operating voltages. However, conventional SIBs using liquid electrolytes remain susceptible to leakage, flammability, poor thermal stability, and dendrite-induced short circuits, limiting their safety and long-term reliability. Solid-state sodium batteries (SSSBs) address these limitations by replacing liquid electrolytes with solid electrolytes exhibiting high ionic conductivity and mechanical stability. Among the various solid electrolytes investigated, including polymers, sulfides, halides, and oxides, NaSICON (Sodium Super Ionic Conductor) materials are considered the most promising oxide-based electrolytes because of their high ionic conductivity, excellent air and chemical stability, wide electrochemical stability window, and robust mechanical properties [1,2]. NaSICON materials were independently discovered by Hong and Goodenough in 1976 [3,4]. Their three-dimensional framework of interconnected ZrO_6 octahedra and $(\text{SiO}_4/\text{PO}_4)$ tetrahedra creates continuous sodium-ion migration pathways, enabling optimized compositions to achieve room-temperature ionic conductivities approaching those of liquid

electrolytes while maintaining superior thermal and chemical stability. Despite significant progress, several challenges remain. Conductivity improvements achieved through aliovalent doping, advanced sintering, and interface engineering are often offset by grain-boundary resistance, sodium volatilization, secondary-phase formation, mechanical degradation, and instability at the sodium-metal interface. Consequently, high ionic conductivity alone is insufficient; practical SSSBs require simultaneous optimization of crystal chemistry, microstructure, processing, interfacial stability, and electrochemical durability. Another challenge is the wide variation in reported dopant effects, processing methods, and electrochemical performance. Differences in synthesis routes, densification, grain-boundary chemistry, and testing conditions often produce conflicting conductivity values for similar compositions. Therefore, meaningful comparison requires consideration of both intrinsic structural properties and extrinsic microstructural effects rather than conductivity alone [2,5,6,7–12]. Recent computational approaches, including Density Functional Theory (DFT), Molecular Dynamics (MD), and Quasi-Elastic Neutron Scattering (QENS), have provided atomic-scale insights into sodium-ion migration, activation energies, and defect chemistry. Combined with advanced experimental characterization, these methods facilitate the rational design of NaSICON electrolytes with enhanced ionic conductivity and interfacial stability [5].

Accordingly, this review summarizes recent advances in NaSICON research while critically examining the relationships among crystal structure, ion transport, compositional engineering, processing strategies, grain-boundary phenomena, and interface chemistry. It highlights unresolved scientific challenges, conflicting experimental observations, and barriers to commercialization, providing a comprehensive roadmap for the development of next-generation NaSICON solid electrolytes for solid-state sodium batteries.

2. Crystal Structure and Ion Transport Mechanics

The superior electrochemical performance of NaSICON electrolytes arises from their three-dimensional crystal framework, which provides continuous sodium-ion migration pathways and high structural stability. Unlike many oxide solid electrolytes with one- or two-dimensional diffusion channels, NaSICON enables isotropic three-dimensional ion transport, resulting in high room-temperature ionic conductivity [1-3].

2.1 The Host Framework

NaSICON materials have the general formula $\text{Na}_{1+x}\text{Zr}_2\text{Si}_x\text{P}_{3-x}\text{O}_{12}$, where sodium occupies mobile-ion sites, zirconium forms the octahedral framework, and silicon/phosphorus constitute the tetrahedral polyanion network [3]. The structure comprises corner-sharing ZrO_6 octahedra and $(\text{SiO}_4/\text{PO}_4)$ tetrahedra that form the characteristic Lantern unit described by Goodenough and co-workers [4]. Their three-dimensional interconnection creates open channels and interstitial sites that facilitate sodium-ion migration. NaSICON crystallizes in monoclinic (C2/c) or rhombohedral (R-3c) phases depending on composition and temperature [13]. The rhombohedral phase generally exhibits higher ionic conductivity because its higher symmetry enlarges diffusion bottlenecks and lowers migration barriers [5,13]. However, DFT and MD studies show that conductivity also depends on sodium occupancy, vacancy concentration, bottleneck geometry, and lattice dynamics. Thus, optimum performance is achieved by balancing carrier concentration and mobility rather than maximizing either alone [2,5,12]. The NaSICON framework also accommodates extensive cationic and polyanionic substitutions without structural collapse, enabling compositional tuning of ionic conductivity, electrochemical stability, and mechanical properties [1,2].

2.2 Sodium-Ion Diffusion Pathways

Sodium ions occupy two crystallographic

sites, Na(1) and Na(2), which enable cooperative three-dimensional ion transport through continuous hopping between adjacent sites [3,5]. Ion migration is mainly controlled by the oxygen bottleneck connecting neighboring polyhedra, whose size depends on framework composition and sodium content. Compositions near $\text{Na}_{3.4}\text{Zr}_2\text{Si}_{2.4}\text{P}_{0.6}\text{O}_{12}$ generally exhibit the highest ionic conductivity owing to an optimal balance of sodium concentration, vacancy distribution, and bottleneck dimensions [2,13]. Recent DFT, MD, impedance spectroscopy, and QENS studies demonstrate that sodium transport is governed not only by bottleneck size but also by electrostatic interactions, local structural disorder, lattice vibrations, and cooperative multi-ion hopping [2,5]. Increasing bottleneck size or vacancy concentration improves conductivity only up to an optimum level, beyond which structural stability or carrier concentration is compromised [2,5,12]. The strong agreement between computational modelling and experimental characterization has significantly advanced understanding of NaSICON ion transport. Future integration of DFT, MD, neutron scattering, synchrotron diffraction, and advanced electrochemical techniques will further support the rational design of high-performance NaSICON electrolytes with improved conductivity and interfacial stability [5,11].

3. Compositional Tuning and Doping Strategies

The high ionic conductivity of NaSICON electrolytes results from both their three-dimensional framework and their compositional flexibility. By modifying framework cations or the Si/P polyanion network, sodium concentration, lattice parameters, diffusion pathways, grain-boundary chemistry, and phase stability can be optimized. Undoped $\text{Na}_3\text{Zr}_2\text{Si}_2\text{PO}_{12}$ (NZSP) typically exhibits room-temperature ionic conductivity of $\sim 10^{-3} \text{ S cm}^{-1}$, while practical solid-state batteries require higher conductivity with low grain-boundary

resistance and stable interfaces [2,5]. Doping effectiveness depends strongly on dopant type, concentration, synthesis route, and resulting microstructure. Excessive substitution may induce lattice distortion or secondary phases, reducing conductivity and stability. Moreover, high bulk conductivity does not necessarily translate into high total conductivity because grain boundaries, porosity, and interfaces often dominate overall resistance [2,5,6–9,12].

3.1 Cation Substitutions at the Zr Site

Aliovalent substitution at the Zr site is widely used to modify sodium concentration, defect chemistry, and diffusion pathways.

Trivalent dopants (Sc^{3+} , Al^{3+} , Y^{3+} , Ga^{3+} , In^{3+}) increase sodium content to maintain charge neutrality, promoting wider diffusion channels and lower migration barriers [2,5,14]. Sc substitution stabilizes the rhombohedral phase and can achieve conductivities above 3 mS cm^{-1} [5], while Al additionally enhances ceramic densification and reduces grain-boundary resistance by acting as a sintering aid [15]. However, excessive trivalent doping may produce lattice distortion and insulating secondary phases.

Pentavalent dopants (Nb^{5+} , Ta^{5+} , Sb^{5+}) generate sodium vacancies that improve ionic mobility by lowering electrostatic interactions, but excessive vacancy concentrations reduce carrier density and overall conductivity [6].

Overall, conductivity enhancement depends on balancing lattice geometry, carrier concentration, defect chemistry, microstructure, and processing rather than on any individual dopant [1,5-6,12].

3.2 Alterations at the Polyanion (Si/P) Site

Modification of the Si/P framework provides another route for improving NaSICON performance. Optimizing the Si/P ratio or partially substituting BO_4 , SO_4 , or GeO_4 units alters lattice dimensions, Na–O bond strength, and migration barriers through the inductive effect, thereby facilitating sodium

-ion transport [16]. Excessive substitution, however, may destabilize the crystal structure and reduce mechanical stability, requiring careful optimization [12,16].

The comparative performance of representative NaSICON electrolytes is shown in **Table 1**.

The reported studies demonstrate that no single doping strategy universally maximizes performance. Electrolyte behavior is governed by the combined effects of crystal chemistry, defect structure, densification, grain-boundary characteristics, and interfacial resistance. Therefore, future optimization should integrate compositional design with processing and interface engineering to achieve high conductivity and durable solid-state sodium batteries [2,7–12].

4. Synthesis and Processing Paradigms

The performance of NaSICON electrolytes depends not only on crystal chemistry but also on synthesis and processing, which determine grain size, density, porosity, grain-boundary chemistry, and secondary phases. Consequently, processing plays a critical role in converting high bulk conductivity into high total ionic conductivity [2,7-8, 12]. The primary objective is to produce phase-pure, highly dense (>95%) ceramics while minimizing sodium volatilization and grain-boundary impurities.

4.1 Conventional Solid-State Reaction

The conventional solid-state reaction is the most widely used synthesis method because of its simplicity and scalability. Stoichiometric mixtures of Na_2CO_3 , ZrO_2 , SiO_2 , and $\text{NH}_4\text{H}_2\text{PO}_4$ are mixed, calcined ($\approx 900\text{--}1100\text{ }^\circ\text{C}$), compacted, and sintered ($>1200\text{ }^\circ\text{C}$) to form dense NaSICON ceramics [1]. However, prolonged high-temperature processing promotes sodium and phosphorus volatilization, coarse grain growth, residual porosity, and secondary phases such as ZrO_2 and sodium phosphates, increasing grain-boundary resistance and reducing total ionic conductivity. Although cost-effective, this method provides limited control over phase purity and microstructure compared with

advanced processing techniques [7-8].

4.2 Wet-Chemical Methods

Wet-chemical routes provide atomic-level precursor mixing, reducing diffusion distances and enabling phase-pure NaSICON powders at lower temperatures.

Sol-gel processing produces highly homogeneous, fine powders through polymeric precursor networks, improving sinterability while reducing sodium loss and grain-boundary contamination [17].

Hydrothermal/solvothermal synthesis directly forms crystalline nanoparticles with controlled morphology and particle size, resulting in improved densification and lower calcination requirements [18].

Although these methods improve compositional homogeneity and lower processing temperatures, they require expensive precursors, strict control of solution chemistry, and remain difficult to scale industrially. Combining wet-chemical synthesis with advanced densification techniques such as Spark Plasma Sintering (SPS) or the Cold Sintering Process (CSP) offers a promising strategy for high-performance, scalable manufacturing [7-8,17–18].

4.3 Advanced Sintering Techniques

Advanced densification methods have been developed to achieve high density while minimizing sodium loss and grain-boundary resistance.

Spark Plasma Sintering (SPS) uses pulsed electric current and uniaxial pressure to rapidly densify NaSICON at lower temperatures, producing near-theoretical density, limited grain growth, and excellent total ionic conductivity. Nevertheless, sodium volatilization under vacuum requires careful optimization of processing conditions [17].

Cold Sintering Process (CSP) densifies ceramics below $\sim 300\text{ }^\circ\text{C}$ using pressure and a transient liquid phase, greatly reducing energy consumption and sodium loss while improving grain-boundary transport. However, electrolyte performance is highly sensitive to transient liquid chemistry, which

can introduce amorphous phases and interfacial impurities if not carefully controlled [18].

Processing–Structure–Performance Relationship

NaSICON performance is governed by the strong relationship between processing, microstructure, and electrochemical properties. Processing controls grain size, density, porosity, grain-boundary chemistry, and impurity distribution, which directly influence ionic conductivity, mechanical integrity, and interfacial stability. Thus, optimizing NaSICON electrolytes requires simultaneous control of composition, processing parameters, and microstructure rather than crystal chemistry alone. Although SPS and CSP significantly reduce grain-boundary resistance without altering the crystal structure, challenges related to cost, scalability, reproducibility, and process control remain. Future research should focus on scalable, energy-efficient manufacturing methods capable of producing dense, phase-pure NaSICON electrolytes with minimal sodium volatilization and excellent electrochemical reproducibility [2,7-8,12]. The comparison of advanced processing techniques is presented in **Table 2**.

5. Interfacial Challenges and Engineering

Despite their high bulk ionic conductivity, NaSICON electrolytes are primarily limited by grain-boundary and electrode/electrolyte interfacial resistance rather than intrinsic lattice transport. Poor physical contact, chemical instability, and mechanical degradation increase total cell impedance, making interfacial engineering essential for practical solid-state sodium batteries [2,9,11-12]. Unlike liquid electrolytes, solid electrolytes cannot accommodate electrode volume changes, leading to stress accumulation, void formation, and contact loss during cycling.

5.1 NaSICON/Sodium Metal Interface

The NaSICON/sodium interface is a major challenge because direct contact with metallic sodium causes chemical, electrochemical,

and mechanical degradation despite sodium's high theoretical capacity [9].

Chemical and Electrochemical Instability

NaSICON is thermodynamically unstable against sodium metal, leading to interfacial decomposition and increased resistance. Poor wettability, non-uniform current distribution, grain-boundary defects, and surface contaminants such as NaOH and Na_2CO_3 further promote interfacial degradation and dendrite nucleation [9–12].

Grain-Boundary Resistance

Grain-boundary impurities, residual porosity, and secondary phases generated during sintering impede sodium-ion transport, often making grain-boundary resistance much larger than bulk resistance. Advanced densification methods such as Spark Plasma Sintering (SPS) and Cold Sintering Process (CSP) effectively reduce these resistive effects [7–9,12].

Sodium Dendrite Formation

Sodium dendrites propagate preferentially through pores, grain boundaries, and microcracks rather than the crystal lattice. Eliminating structural defects and maintaining uniform sodium-ion flux are therefore essential for stable cycling.

Engineering Strategies for Stable Sodium Interfaces

Interfacial coatings including NaF-rich layers, CuO-derived interphases, alloy coatings (Sn, Bi, In), and ceramic coatings improve wettability, suppress side reactions, and reduce charge-transfer resistance [10-11]. Surface polishing and polymer/composite buffer layers further improve contact and relieve mechanical stress. However, long-term stability of artificial interlayers remains a key challenge requiring chemically stable and mechanically compliant interphases [9–11].

5.2 NaSICON/Cathode Interface

Limited solid–solid contact, cathode volume changes, space-charge formation, electrolyte oxidation, and transition-metal diffusion increase interfacial resistance, polarization, and capacity fading during cycling [9,11-12].

Engineering Solutions

Protective coatings (Al_2O_3 , ZrO_2 , LiNbO_3), composite catholytes, polymer–ceramic hybrids, ball milling, co-sintering, and polymer/plastic-crystal infiltration improve interfacial contact and ionic transport. However, these approaches introduce inactive components that reduce energy density, requiring optimization of conductivity, mechanical compliance, and electrochemical stability [9–12].

Future Directions for Interface Engineering

Future progress requires atomic-scale understanding of interface evolution. Advanced characterization techniques, including synchrotron X-ray diffraction, TEM, ToF-SIMS, XPS, and in situ electrochemical impedance spectroscopy, combined with Density Functional Theory (DFT) and Molecular Dynamics (MD), are enabling the rational design of stable interfaces with lower charge-transfer resistance, suppressed dendrite formation, and improved long-term cycling performance [5,9,11–12].

6. Future Perspectives

NaSICON-type solid electrolytes are among the most promising oxide electrolytes for room-temperature solid-state sodium batteries due to their three-dimensional ion-conducting framework, high ionic conductivity, chemical stability, and compatibility with abundant sodium resources. Significant progress has been made in understanding the relationships among crystal structure, ion transport, compositional tuning, microstructure, and electrochemical performance.

This review highlights that electrolyte performance depends not only on high bulk ionic conductivity but also on the combined optimization of defect chemistry, grain-boundary characteristics, interfaces, and processing. Although aliovalent doping, advanced sintering, and interface engineering have substantially improved NaSICON performance, practical battery operation remains strongly influenced by the interplay

between crystal chemistry, microstructure, and electrode/electrolyte interfaces. Furthermore, reported conductivities often vary because of differences in synthesis, densification, precursor chemistry, and testing conditions, emphasizing the need for standardized characterization protocols for ionic conductivity, activation energy, critical current density, and interfacial resistance [2,9,11].

Grain-boundary resistance remains a major obstacle despite excellent bulk conductivity. Secondary phases, porosity, structural disorder, and space-charge effects increase total resistance, while advanced densification methods such as Spark Plasma Sintering (SPS) and the Cold Sintering Process (CSP) have demonstrated effective reduction of grain-boundary impedance. However, scalability, reproducibility, processing cost, and sodium volatilization remain important challenges [7,8].

Interfacial instability at both sodium-metal and cathode interfaces also limits long-term performance. Electrolyte reduction, poor sodium wettability, dendrite formation, space-charge effects, oxidative degradation, and mechanical contact loss contribute to increased impedance and capacity fading. Consequently, artificial interlayers, protective coatings, composite catholytes, and compatible buffer layers will remain central to future NaSICON development [9–12].

Recent advances in Density Functional Theory (DFT), Molecular Dynamics (MD), phase-field modelling, and machine-learning-assisted materials discovery, combined with advanced experimental characterization, are accelerating the rational design of NaSICON electrolytes with improved conductivity, lower grain-boundary resistance, enhanced interfacial stability, and superior electrochemical durability [5,11].

Several important research directions deserve particular attention in the coming years

(I) Advanced Compositional Engineering: Develop multi-element co-doping strategies,

supported by computational screening, to optimize sodium vacancies, diffusion pathways, lattice stability, and grain-boundary chemistry.

(ii) Grain-Boundary Engineering: Minimize grain-boundary resistance through advanced sintering, controlled-atmosphere processing, surface modification, and elimination of insulating secondary phases.

(iii) Interface Stabilization: Design chemically stable, electronically insulating, and mechanically compliant interlayers to suppress dendrites, improve sodium wettability, and maintain low interfacial resistance during long-term cycling.

(iv) Advanced Characterization: Expand the use of in situ and operando techniques, including synchrotron and neutron diffraction, TEM, XPS, ToF-SIMS, Raman spectroscopy, and electrochemical impedance spectroscopy, to monitor ion transport and interface evolution.

(v) Computational Materials Design: Integrate DFT, MD, Monte Carlo simulations, and machine learning with experiments to predict defect chemistry, migration barriers, electrochemical stability, and optimized NaSICON compositions.

(vi) Commercialization Challenges: Address scalable, cost-effective synthesis, reproducible densification, sodium volatilization, compatibility with high-energy cathodes, long cycle life, and industrial manufacturing.

(vii) Practical Battery Performance: Evaluate NaSICON electrolytes under commercially relevant conditions, including high cathode loading, lean sodium inventory, practical stack pressure, wide operating temperatures, and extended cycling, to accelerate translation from laboratory research to practical solid-state sodium batteries.

The comparison of representative strategies for improving NaSICON electrolytes is presented in Table 3

7. Conclusion

Overall, NaSICON electrolytes continue to represent one of the most mature and scientifically promising classes of ceramic solid electrolytes for next-generation sodium batteries. Their exceptional combination of high ionic conductivity, structural robustness, and chemical stability provides an excellent foundation for future development. Nevertheless, continued progress will require a multidisciplinary approach integrating crystal chemistry, computational modelling, advanced processing, interface engineering, and industrial manufacturing. Through such coordinated efforts, NaSICON-type solid electrolytes are expected to play a pivotal role in enabling safe, low-cost, and high-energy-density solid-state sodium batteries for large-scale grid storage, renewable energy integration, and future electric transportation.

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Table 1. Representative NaSICON compositions and their electrochemical characteristics.

Composition	Modification Strategy	Approximate Room-Temperature Ionic Conductivity	Major Advantage	Major Limitation	Ref.
$\text{Na}_3\text{Zr}_2\text{Si}_2\text{PO}_{12}$	Undoped NZSP	$\sim 0.7\text{--}1.0 \text{ mS cm}^{-1}$	Excellent chemical stability	Moderate conductivity	[12]
Sc-doped NZSP	Trivalent substitution	$>3 \text{ mS cm}^{-1}$	Enlarged diffusion bottlenecks; rhombohedral stabilization	Optimum Sc concentration required	[5]
Al-doped NZSP	Trivalent substitution	$2\text{--}3 \text{ mS cm}^{-1}$	Improved sintering; lower grain-boundary resistance	Secondary phases at high Al content	[15]
Nb-, Ti-, Y-, Zn-doped NZSP	Vacancy engineering	Composition dependent	Lower activation energy	Strong dopant-concentration dependence	[6]
SPS-processed NZSP	Advanced densification	High total conductivity	Near-theoretical density	Sodium volatilization	[7]
Cold-sintered NZSP	Low-temperature processing	Improved grain-boundary transport	Energy-efficient processing	Sensitive processing conditions	[8]

NaSICON-Type Solid Electrolytes: High-Conductivity Frameworks for Next-Generation Sodium Batteries

Table 2. Comparison of Advanced Processing Techniques

Processing Route	Typical Temperature	Relative Density	Advantages	Limitations	Ref.
Conventional solid-state	High	Moderate	Simple, inexpensive	Na volatilization, porous microstructure	[1]
Sol-gel	Moderate	High	Excellent chemical homogeneity	Higher processing complexity	[17]
Hydrothermal	Low	High	Fine particle size	Scale-up challenges	[18]
Spark Plasma Sintering	Lower than conventional	Near theoretical	Rapid densification, reduced grain-boundary resistance	Vacuum-assisted Na loss	[7]
Cold Sintering Process	Very low	High	Energy-efficient, minimal thermal degradation	Sensitive transient liquid chemistry	[8]

Table 3. Comparison of representative strategies for improving NaSICON electrolytes.

Strategy	Major Improvement	Limitation	Ref.
Sc doping	Enlarged diffusion bottlenecks and increased conductivity	Optimum concentration required	[5]
Al doping	Improved sintering and lower grain-boundary resistance	Secondary phases at excessive doping	[15]
Nb/Ti/Y/Zn doping	Vacancy engineering and activation-energy reduction	Composition dependent	[6]
Spark Plasma Sintering	High densification and reduced porosity	Vacuum-induced Na volatilization	[7]
Cold Sintering Process	Low-temperature densification and energy efficiency	Sensitive to transient liquid chemistry	[18]
Artificial interlayers	Stable Na interface and dendrite suppression	Additional processing step	[9–11]
Catholyte engineering	Better wetting and lower interfacial resistance	Long-term stability still under investigation	[9,11-12]

Duḥkha: The First Noble Truth-A Metaphysical Quest

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Abstract

Among the Four Noble Truths, the first one is Duḥkha. The term '*Four Noble Truths*' originates from the Pali term *Chattari-ariyasaccani*. Buddha says "SarvamDuḥkham". This means everything in this world is associated with pain. No one can avoid pain as it is the integral part of our existence. There are mainly three types of Duḥkha namely, Duḥkha Duḥkha, Viparināma- Duḥkha and Sankhara-Duḥkha. Though most of the Indian philosophical schools have dealt with this problem, Sāṅkha and over all view of Upaniṣad and Nyāya are briefly discussed. Like Buddhism, However, their views are more theoretical. But as Buddha was primarily an ethical teacher and social reformer, he had an aversion to theoretical speculation. His teachings have a practical basis because they are rooted in empirical observation and direct experience. He has shown that through ethical practices and meditation, liberation can be achieved. This has made him a mystical idealist. His Philosophy, therefore, has an optimistic approach.

Introduction

The sighs of suffering that distress the mind of young Sidhartha were of disease, old age and death. He realized that life ultimately leads to suffering i.e. *Sarvam Duḥkham*. Therefore, among the Four Noble Truths, the first one is 'Duḥkha'. Although the term Four Noble Truth is well known in English, it springs from the Pali term '*Chattari-ariya- saccani*.' The Four Noble Truths is mentioned in the second part of the *Dhammacakkapavatta Sutta*. The main objective of Buddha is how to stop the dynamic flow of constituents of living being.

The object of this paper is to show that Buddha comes ultimately to the conclusion that a being should arrive through changing state ('Anitya') to an everlasting unchanging state of rest and peace which is called 'Nirvāṇa'. This paper has three sections and a conclusion. The first section is dealt with according to Buddha, what is Duḥkha and what are the miseries in life. It also includes different types of Duḥkha. in the second section some observations have been made from the point of views of Sankha, Upaniṣad and Nyāya on the one hand and Buddha on the other hand regarding the concept of Duḥkha. Third section discusses that though he has realized life is full of suffering but at the same time he is optimistic as he has shown the right path to refrain from it. A concluding remark has also been given where it will be shown that Buddhist theory transcends from commonsense realism to mystical idealism.

Section I

The Four Noble Truths can only be realized by the noble person. There is nobleness in their discovery and they are noble because they are real, honest, straightforward and not misleading. The First Noble truth is -there is suffering. The Second Noble Truth is- there are causes of suffering, the Third Noble Truth is- there is a cessation of suffering and the Fourth Noble Truth is- there are means for the cessation of suffering. The etymological meaning of Duḥkha is- Duḥkha= du + kham, 'Du' means bad in the sense of vile and 'kham' means empty or 'tuccha'. Duḥkha is vile as it is the cause of many dangers. It is empty too as it lacks beauty, lastingness, happiness and self of its own. Suffering is birth, old age, disease, death, sorrow, grief, wish, despair, i.e. all that

Duḥkha: The First Noble Truth-A Metaphysical Quest

is born of attachment. There are mainly three types of suffering: -

1. Duḥkha - Duḥkha (suffering of suffering) – this kind of suffering includes physical and mental sufferings.

2. Vipariṇāma Duḥkha - It refers to the impermanence of happiness and pleasure which ultimately leads to Duḥkha. This is in accordance with the theory of kṣanabhangavāda. The theory has a similarity with Heraclitus's philosophy who holds that everything is in a flux. He says that no one can step in the same river twice.¹

3. Sankhara- Duḥkha (suffering from conditioned existence)- Everything is a product of prior cause and therefore conditioned. This conditioned nature lacks permanence. Even our mental states are also constantly changing.

Suffering has the feature of experiencing an unwanted tangible datum. It is manifested as physical affliction.

Section II

Some observations have been made from the point of views of sāṅkha, upaniṣad and nyāya philosophy and Buddhist theory of Duḥkha. Sāṅkha, like Buddha, also has agreed that all our experiences are sorrowful. According to Sankha Philosophy, we are affected by three kinds of pains--adhyatmika, adhibhautika and adhidaivika. The first is due to intra-organic causes like bodily disorders and mental affections. It includes both physical and mental sufferings. The second is caused by the extra-organic natural causes like men, beasts, thorns etc. Third kind of suffering is caused by extra -organic supernatural causes. However, according to Sankha, suffering and bondage are due to the feeling of identity (aviveka) between Puruṣa (consciousness) and Buddhi or mahat (one of the products of the evolution of Prakṛti). Freedom from suffering comes from knowledge of the distinction between the self and non-self.² Though both in Upaniṣad and Buddhism it is accepted that suffering is due to ignorance or 'avidyā' but the implications of the term 'avidyā' are different. Like Upaniṣad, 'avidyā' in Buddhism, is not meant as a cosmic power for explaining how

the niṣprapañca Brahman appears as the empirical world, but merely as the ground of individual existence due to the 'chain of causation', i.e. Pratityasamutpāda. The Naiyāyikas also believe that the world is full of sorrow and that the small bits of pleasure only serves to intensify the force of sorrow. To a wise person, therefore, everything is full of misery. 'Sarvam Duḥkham vivekinah'³. Duḥkha-janma-pravṛtti-doṣa-mithyājñānānām-uttarottarāpāyetad-anantarāpāyād-apavargaḥ⁴

Due to mithyājñāna, doṣa is produced. Due to doṣa, pravṛtti is produced, due to pravṛtti, janma takes place and due to janma, duḥkha is produced. The bondage of the world is due to false knowledge (mithyājñāna) which consists in thinking as my own self that which is not myself, namely body, senses, manas, feelings and knowledge; when one knows the true knowledge of sixteen padārthas, pramāṇas, prameya, and of the other logical categories of inference is realized, false knowledge is demolished. False knowledge is eradicated by constant thinking of its opposite (pratipakṣabhāvanā). For example, when any pleasure attracts us, we are to think that this is in reality but pain and nothing else. Thus, a wise person does not get attracted to the so-called pleasures of life which ultimately leads to the sorrow. That is why in Nyāya Sutra, Goutama has stated- 'Tattvajñānat niṣreyasādhigamaḥ'⁵. This means that liberation can be attained by the knowledge of the true nature of the sixteen categories i.e. pramāṇa, prameya, saṃśaya, prayojana, dṛṣṭānta, siddhānta, avayava, tarka, nirṇaya, vāda, jalpa, vitandā, hetvābhāsa, chala, jāti, nigrahaṣṭhāna.⁶

Section III

Buddha is of the opinion that human suffering is due to man's attachment, greed that spring out of his ignorance about the true nature of individual himself as well as the objects themselves. Individuals are nothing but a collection of physical and mental constituents. He supports common sense realism by supporting the doctrine impermanence and dependent origin.

According to Buddha, objects exist in a dynamic process of cause and effect. Nothing is permanent in this world of experience. This can be understood by direct, observable sensory experience rather than abstract imagination. Common sense realism holds that the world is active and changing. Buddha confirms this by denying the eternal existence of both physical and mental substances. He says that the changing nature of objects directly aligns with our everyday experience of the world. He has shown that suffering and its causes can be seen as moving in a circular way, i.e. from birth comes death and again from death comes a new birth, but at the same time he has shown us the path of absolute cessation of suffering. He is an ethical teacher who looks upon life with its suffering as a disease and as a doctor he has found out a remedy for it. He has discouraged engaging in any theoretical discussions that do not contribute directly to the practical goal of alleviating suffering. He has emphasized on direct experience and practice over speculation and dogma. This is the reason his philosophy is optimistic in nature and he is different from other Indian philosophical schools. Perfect control of passions and constant contemplation of truth lead a person to attain 'Nirvāṇa'. A person who does his deeds with perfect insight into the real nature of the universe and without attachment, does not create a karma producing rebirth. A person who does his actions without 'raga', 'dosa' and 'moha' is compared like a sowing seed which have been fried and made barren i.e. he will be untouched by the consequences of his actions. After a person attains nirvāṇa, his enlightened heart begins to beat with sympathy for the countless beings who are still writhing in pain. Love and sympathy for all beings increase with enlightenment and persuade the perfect

man to share his wisdom with them and work for their moral upliftment. The path, recommended by Buddha, consists of eight steps which is known as 'Aṣṭāṅgika –mārga'. This path is open to all.

Samyagdr̥ṣṭi, samyaksañkalpa,
samyagvāksamyakkarmānta,
samyagājīva, samyagvyāyāma,
samyakasmṛti, samyaksamādhi.

Conclusion

It can be concluded by saying that Buddha's ethical teachings comprises of three pivotal things- conduct ('śīla'), concentration ('Samādhi'), and knowledge ('prajñā') harmoniously cultivated. In modern psychology it is said that a divided personality means that there are two constantly conflicting forces working together at the same time – the good and the bad one. The practice of Eight-Fold Path makes a person so disciplined and a purifying soul that this conflict, in him, abolishes. Repeated contemplation of what is true and good, training of the will and emotion accordingly, through determination and desireless behavior, progressively achieve the harmonious personality in which thought, will and emotion are all thoroughly refined and purified in the light of truth. Perfect wisdom, perfect goodness, and perfect equanimity gives the 'Arhat' complete relief from suffering. With the development of Mahayana Buddhism, specially Yogachara school holds that all external phenomena and matter are projections of mind and only pure consciousness is real (ālayavijñāna). Here it is observed that this theory encompasses common sense realism and steps into mystical idealism. This process is surely a metaphysical quest by which 'Arhat' attains 'Nirvāṇa'.

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Immunostimulation in HIV/AIDS Therapeutics: A Novel Paradigm Shift

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Abstract:

The immune system is an organization made up of molecular and cellular elements that play specific roles in protecting the body from outside invasion. There are two well-known types of immune responses: (a) innate responses, which are our body's initial line of defense against foreign antigens, and (b) acquired responses, which are an enhanced physiological reaction to a recurrent non-self exposure. One of the most well-known diseases is the human immunodeficiency virus (HIV), which mainly targets the immune system to make its victim vulnerable to a variety of secondary infections. Immunostimulation is a technique that uses sophisticated medication and the effective application of other specialized substances, such as different biomolecules, organic herbs, metals, and nano-materials, to strengthen the otherwise weakened immune system. HIV infection has posed a serious threat to civilized society for many years, necessitating awareness and safety precautions in order to live a healthy life. One such effective strategy for leading a healthy lifestyle is immunostimulation. In addition to considering the relative potential of the various immunostimulants and reports on the efficacy of immunostimulation against HIV/AIDS, the current review aims to revisit the classical mechanisms involved in immune response with particular reference to its activation induced through specific immunostimulants.

Key words: HIV/AIDS, Innate immunity, acquired immunity, secondary infection, immunostimulation.

Introduction:

In addition to fending off foreign invaders, the immune system also works to eradicate them. In order to evade the host's immune system's detection and neutralization, pathogens quickly change and adapt. The animal kingdom has a variety of defensive systems to combat infections (1). The diverse array of plants, fungi, invertebrates, and lower vertebrates that are descended from ancient eukaryotes still possess fundamental immune systems. Complement system, phagocytosis, and antimicrobial peptides are few of these systems (2). Humans and other higher organisms have more sophisticated defense systems. A broad range of illness like acquired immunodeficiency syndrome/AIDS is brought on by infection with human immunodeficiency virus (3).

IMMUNOSTIMULATION: A GLIMPSE FROM HISTORY

The concept of immunostimulation originated in 10th century China with variolation against smallpox, which involved exposing healthy individuals to materials from smallpox lesions. Despite its early application, its appeal was constrained by uneven results. Mary Montague's successful variolation of her children in 1772 contributed to the practice's rise in popularity in America and England (4). In addition to proving the effectiveness of vaccinations, Edward Jenner's 1796 injection of James Phipps with cowpox material challenged pre-existing miasma beliefs and helped develop Louis Pasteur's germ theory.

Robert Koch identified microbes as the source of infectious diseases by 1891, while Walter Reed recognized viruses as

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human pathogens in 1901 (5). Paul Ehrlich's side-chain theory on antigen-antibody interaction, which earned him the Nobel Prize in 1908 alongside Metchnikoff, a pivotal figure in cellular immunology (6), was one of the major advances at this time. Important ideas developed, such as the germ theory of Koch and Pasteur, the transferable immunity through serum proposed by Von Behring and Kitasato, and the role of phagocytes in pathogen defense proposed by Metchnikoff. Because of his contributions to serum treatment, von Behring was the first person to win the Nobel Prize in Physiology/Medicine (7).

Immune Response to Antigens: The Cross-Talk

Conventional understanding of an immune system that is triggered by alien molecules or specific elements of a changed self has given way to a system that is tailored to identify subtle changes in homeostasis, including signals that are more elusive (8). The immune system's evolution offers a wide range of chemicals, and adaptability of sensors and intricate interactions between effectors and regulatory networks imply that the ultimate purpose of immune response goes beyond just eliminating infections to preserve homeostasis (9). A finely balanced act that necessitates many checks and overlapping or redundant degrees of modulation to enable effective immune responses with little collateral damage to the host is suggested by additional complexity such as, interaction between basic and specialized cellular processes (10).

An APC, typically MΦ or dendritic cell in conjunction with a B or T cell, is necessary for the response to foreign antigen. B cell is triggered to multiply (active plasma cell) and generate antibodies that specifically bind antigens when an APC displays antigen on its cell surface (11). Antibodies serve as a signal for PMNs/MΦ to phagocytise and destroy bacteria/parasites if they attach to their antigens. Antibodies also play crucial role in starting "complement destruction cascade". Serum proteins known as

complement attach to immobilized antibodies when they attach to cells or bacteria, rupturing the germs by making holes in them (12,13). Antibodies can also signal NK cells and MΦ to kill viral/bacterial-infected cells. T cells are activated when the antigen is presented to them by APC. In case of CD4⁺ T cells (14), activated T cells multiply and become secretory; in case of CD8⁺ T cells, they become activated to eliminate target cells that express the antigen that the APC has presented. The CD4⁺ T_H cell subset plays a major role in controlling both the activity of CD8⁺ killer T cells and generation of antibodies (15). These cells get signals from CD4⁺ T_H cells, which prompt them to multiply and perform better. NK cells, MΦ, CD8⁺ T cells, and PMNs are frequently activated by the variety of cytokines that CD4⁺ T_H cells make and secrete (16).

HIV/AIDS: Historical Perspective

HIV is believed to have originated from a virus in West African chimpanzees in 1930s, primarily spreading to humans through blood transfusions during hunting. The first human case of HIV-1 infection was identified in a blood sample from Congo (17). AIDS was first reported in 1981 among injectable drug users and homosexual men with symptoms like Kaposi's sarcoma. Initially referred to as Gay-related Immune Deficiency (GRID), the term AIDS was formalized in 1982 when HIV was confirmed as the cause by virologist Montagnier and Gallo (18).

With high rates in Sub-Saharan Africa and South-East Asia, AIDS has become a worldwide pandemic over time. Approximately 39 million individuals worldwide; 37.2 million adults and 1.8 million children under the age of 15; were living with HIV/AIDS in 2018 (19). Since its discovery, HIV-1 has killed over 25 million people and infected over 60 million. The number of AIDS patients is steadily declining while being a serious health risk; in 2018, 23 million people received antiretroviral medication (ART) globally (20).

HIV SUB-TYPES:

The great genetic diversity of HIV-1 is well known. HIV-1 has four subtypes: M, N, O, and P. Group M is the most commonly reported HIV in the world, while Group N and Group O account for 1% of all HIV-1 cases and are primarily found in Cameroon and Gabon (21). With a prevalence of 0.06% of all HIV infections, Group P is the rarest of all and has been found in pregnant Cameroonian women in France. Senegal has the highest incidence of HIV-2, which is most prevalent in West Africa (22). There are eight subtypes of HIV-2, designated Group A through H. Group B is more widespread in Ivory Coast, but Group A is more common in the sub-Saharan region. Group C through H are classified as "silent" transmissions that result in no further infections because of the intermittent nature of infection (23,24).

HIV: REPLICATION CYCLE & INFECTION:

The immune system, particularly the CD4⁺ T-lymphocytes, is the primary target of assault. Once infected, the virus silently and gradually overwhelms the host's defenses, leading to otherwise uncommon malignancies and opportunistic infections (25,26). Activation of humoral and cell-mediated immune systems depends critically on activated and differentiated CD4⁺ cells. Peripheral blood CD4⁺ cells are reduced as a result of HIV infection (25,27). Untreated patients experience depletion over a number of years until they pass away from AIDS. It can appear 2-15 years after infection and is the final stage of HIV infection (28).

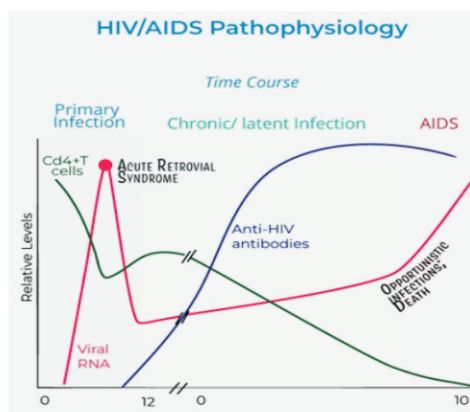


Figure 1 Timeline of HIV infection (source: internet)

The timeline of HIV infection from the first infection to the manifestation of AIDS-specific symptoms is depicted in the above image. Sexual contact, prolonged exposure to bodily fluids, and vertical transmission—the transfer of HIV from mother to child during pregnancy, childbirth, or breastfeeding—are the three main ways that the virus spreads (29). If feces, nasal secretions, saliva, sweat, tears, urine or vomit are not contaminated with blood, there is no danger of contracting HIV. Additionally, co-infection with many HIV strains can occur; this is referred to as HIV super-infection (30).

AIDS virus undergoes a complex replication cycle consisting of several stages: **I. Binding and Fusion:** Viral proteins GP41 and GP120 bind to the CD4 receptor and CCR5 or CXCR4 co-receptors, facilitating membrane fusion and viral entry (31).

II. Reverse Transcription and Integration: Reverse transcriptase converts viral RNA to DNA, integrated into the host DNA by integrase, remaining dormant until the cell activates.

III. Transcription and Translation: Upon activation, viral DNA transcribes to mRNA, leading to new viral protein production (32).

IV. Assembly, Budding, and Maturation: HIV particles bud from the host, where protease processes proteins for mature, infectious particles.

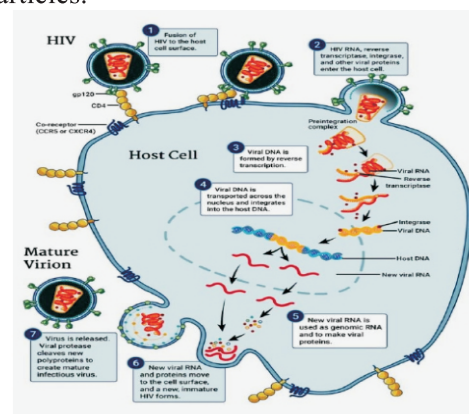


Figure 2 Replication cycle of HIV (source: internet)

As HIV/AIDS weakens the immune system, it predisposes individuals to a range of opportunistic infections (33) such as,

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Gastrointestinal Pathogenesis: Leads to significant illness; symptoms include diarrhea, wasting, and infections like candidiasis and cytomegalovirus. Respiratory Illness: Affecting 60-70% of AIDS patients, common problems include bronchitis, pneumonia, and tuberculosis. Neurological Problems: Manifest as headaches, neuropathy, and cognitive impairments due to opportunistic infections and tumors of the CNS. Skin Disorders: Occur in 80-90% of patients, with conditions such as Kaposi's sarcoma and herpes infections being prevalent. Eye Infections: Affect 60-70% of patients and may include dry eye syndrome and retinitis. This cycle and the associated conditions underscore the critical impact of HIV/AIDS on the immune system and overall health.

IMMUNOTHERAPY & HAART

Primary goals of antiretroviral therapy or highly-active antiretroviral therapies (HAART) (34) are to: **Reduce HIV-related morbidity and prolong the survival of patient, Improve the quality of life during and after the therapy, Restore and preserve immunologic function, Maximally and durably suppress the viral load, and Prevent vertical HIV transmission (mother to child).**

Combination therapies involving at least three medicines from two classes of antiretroviral agents are available. Two NRTIs, such as Lamivudine/ Emtricitabine and Zidovudine/ Tenofovir, are usually used in conjunction with an NNRTI during initial treatment (35). Since 2019, the WHO has recommended Lamivudine and Tenofovir as the first-line treatment for adults, with the option of Tenofovir/ Lamivudine/ Efavirenz.

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When first regimens don't work, ART/HAART uses protease inhibitors. Although it has helped treat HIV as a chronic condition, it can cause serious side effects, such as neurological, gastrointestinal, haematological, musculoskeletal, metabolic, and psycho-behavioral problems (36).

The goal of immunostimulators is to boost immunity without posing major health hazards (37). In Kaposi's sarcoma linked to AIDS, IFN- α exhibits antiviral and antineoplastic qualities. In HIV patients, thalidomide, also called Immunoprin, may raise circulation TNF- α . For geriatric and HIV-positive patients, bestatin has demonstrated efficacy in immunorestitution. Immunizing HIV-1 patients with recombinant proteins or inactivated virus is one of the more recent active immunotherapy approaches (38). Furthermore, it has been discovered that GM-CSF and other haematopoietic growth factors, such as erythropoietin, improve the effectiveness of traditional anti-HIV medications like gancyclovir and zidovudine.

Future Directions:

Currently, a variety of natural or synthetic specific and non-specific immune-stimulants are utilized in immunotherapy and immunoprophylaxis to treat conditions other than HIV/AIDS, such as cancer and rheumatoid arthritis. Despite being one of the most sophisticated medical procedures, it is still mostly limited to industrialized nations. Therefore, it needs to be tested and used more in poor nations in order to achieve the highest level of medical achievement. International organizations like the United Nations, WHO, and UNICEF should take steps to make immunotherapy accessible and inexpensive for the majority of people on the planet.

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‘দি হুগলী কলেজ ম্যাগাজিন’ : ফিরে দেখা

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সারসংক্ষেপ : ‘THE HOOGHLY COLLEGE MAGAZINE’ প্রকাশের পর একশো বছরেরও বেশি সময় অতিক্রান্ত হয়েছে। একটি প্রতিষ্ঠানের বহুমাত্রিক পরিচয়ের হৃদিশ পেতে এমন সারস্বত প্রয়াসের বিকল্প আর কিছু হতে পারে না। বাঙালি ইতিহাসবিস্মৃত জাতি, সংরক্ষণের অভাবে দুর্মূল্য সম্পদ হারিয়ে ফেলাই তার ভবিতব্য। আশ্চর্যের বিষয়, পরশপাথরের মতো ইন্টারনেট থেকে খুঁজে পাওয়া গেল আলোচ্য পত্রিকার একেবারে প্রথম পর্যায়ের কয়েকটি সংখ্যা। সেইগুলো সম্বল করে ফিরে দেখতে চাইলাম কাব্যে উপেক্ষিত এক ইতিহাসকে। অসম্পূর্ণ এই লিখনপ্রয়াসের মধ্য দিয়ে যদি সামান্য আলো পড়ে হুগলি মহসিন কলেজচর্চায়, তাহলে আমাদের অক্ষরযাত্রা সার্থক হয়ে উঠবে।

সূচকশব্দ : দি হুগলী কলেজ ম্যাগাজিন, ইতিহাস, শিক্ষা, সাহিত্য, সংস্কৃতি।

বাংলা সাময়িকপত্রের ইতিহাসে বিভিন্ন প্রতিষ্ঠানের গুরুত্ব কম নয়। স্কুল, কলেজ, বিশ্ববিদ্যালয় প্রভৃতি প্রতিষ্ঠানের পত্রিকাগুলির হৃদিশ পাওয়া বেশ কঠিন। অথচ এর মধ্যেই লুকিয়ে আছে বাঙালির ইতিহাসের অমূল্যরত্ন। ‘দি হুগলী কলেজ ম্যাগাজিন’-এর কয়েকটি সংখ্যাই আমরা যোগাড় করতে পেরেছি। ঐতিহাসিক K. Zakariah তাঁর ‘History of Hooghly College ১৮৩৬-১৯৩৬’ গ্রন্থে জানিয়েছেন—

In 1914 we hear of a proposal to publish a College magazine, but it was not till five years later that the magazine appeared. The cost was met entirely from a levy of one rupee and four annas from each student. There were at first three issues each year and then only two. The magazine was for some years conducted almost

entirely in Bengali, but now there is an English section as well.’

সম্ভবত ১৯১৯ সাল থেকে ‘দি হুগলী কলেজ ম্যাগাজিন’ পথ চলা শুরু করে। ডিসেম্বর ১৯২১ সংখ্যায় সম্পাদক হিসেবে পাই হুগলি কলেজের ইংরেজির লেকচারার কমলকৃষ্ণ ঘোষের নাম। প্রিন্স অব ওয়েলেসের ভারতে আগমন উপলক্ষে এদেশ নতুনভাবে জাগ্রত হয়েছে, সেকথা উঠে এসেছে সম্পাদকীয়তে। সেপ্টেম্বর ১৯২৩ সংখ্যার (বর্ষ ৫ সংখ্যা ১) শেষের পৃষ্ঠা থেকে মুদ্রণগত তথ্য জানতে পারি—

“Printed by Jatindra Nath Mandal, at the Protiva Press, 211-A, Bowbazar Street, Calcutta, and published by Gopal Ch. Bhattacharya, Hooghly College, Chinsurah.”

১৯২০ সালের ডিসেম্বর সংখ্যায় ‘Reminiscences of my School and College Days’ শীর্ষক সুখপাঠ্য গদ্য লিখেছেন তৎকালীন বঙ্গবাসী কলেজের অধ্যক্ষ জি.সি.বোস। ঈশানচন্দ্র ব্যানার্জী ইংরেজির অধ্যাপক ছিলেন। তিনি ক্লাসে বই পড়তে ছাত্রদের উৎসাহিত করতেন। এরই সূত্রে একদিন ক্লাসে বলেছিলেন হুগলি স্কুল ও কলেজের প্রাক্তনী জাস্টিস দ্বারকানাথ মিত্রের কথা। চতুর্দশ খণ্ডের ‘Allison’s History of Europe’ প্রকাশের পরেই চলে এসেছে লাইব্রেরিতে। দ্বারকানাথ তখন ছাত্র, প্রথম দিন প্রথম খণ্ড লাইব্রেরি থেকে নিয়ে পরের দিন ফেরত দিলেন। দ্বিতীয় দিন দ্বিতীয় খণ্ড নিলেন। পরেরদিন সেটা জমা দিয়ে যখন তৃতীয় খণ্ড চাইলেন, বেঁকে বসলেন গ্রন্থাগারিক। পঠিত বই সম্বন্ধে জিজ্ঞেস করলেন। আশ্চর্যের বিষয়, পৃষ্ঠা নম্বরসহ বইয়ের বিষয় বলে দিলেন দ্বারকানাথ! এই লেখাতেই এসেছে বোটানির প্রফেসর ড. জর্জ ওয়াটের প্রসঙ্গ। যিনি হুগলি থেকে নৌকো করে বিভিন্ন গ্রামে ও জঙ্গলে ছাত্রদের নিয়ে

যেতেন জ্ঞানান্বেষণে। প্রফেসর লালবিহারী দে, সংস্কৃতির পণ্ডিত গোপালচন্দ্র গুপ্ত প্রমুখ অধ্যাপকের কথা প্রাঞ্জলভাবে বর্ণিত হয়েছে এই গদ্যে। স্মৃতির আখ্যান ধরে রেখেছে হারিয়ে যাওয়া ইতিহাস।

পত্রিকার পক্ষ থেকে স্মৃতি-লেখাকে উৎসাহিত করা হয়েছিল। পুরোনো সে দিনের কথা লিখেছিলেন মহেন্দ্র চন্দ্র মিত্র বাহাদুর।

(২)

‘চুঁচুড়ার সংক্ষিপ্ত ইতিবৃত্ত’ লেখাটি ধারাবাহিকভাবে প্রকাশিত হয়েছিল হুগলী কলেজের পত্রিকায়। লেখকের নাম আমাদের প্রাপ্ত সংখ্যায় মুদ্রিত হয়নি। ১৯২০ সালের ডিসেম্বর সংখ্যায়, লেখার শুরুতে ওলন্দাজ আমলে শিক্ষার কথা বর্ণিত হয়েছে। ১৮৩২ সালের ১ নভেম্বর, ইংরেজ সরকার অনুদান বন্ধ করে দিলে ওলন্দাজদের প্রতিষ্ঠিত ফ্রি স্কুল ও অন্যান্য বিদ্যালয়গুলির অবস্থা শোচনীয় হয়ে পড়ে। ১৮৩৫ সালে লর্ড বিশপ চুঁচুড়ায় আসেন এবং এক বছরের মধ্যে শিক্ষার উন্নতি সাধিত হয়। ১৮৩৬ সালের ১ আগস্ট ‘COLLEGE OF MOHAMAD MOHSIN’-এর সূচনা ঘটে। ১৯৩৬ সালে শতবর্ষ উদ্‌যাপনের সময় থেকে এই প্রতিষ্ঠানের নাম হয় হুগলী মহসিন কলেজ। যাইহোক, সূচনাপর্বের ইতিহাসটি ফিরে দেখা যাক আলোচ্য লেখার অংশবিশেষ উদ্ধৃত করে—

“১৮৩২ খৃঃ অঃ মহম্মদ মহসীন ফণ্ডের উদ্ধৃত অর্থের কিয়দংশ দ্বারা একটি কলেজ প্রতিষ্ঠা করিবার জন্য ডাক্তার টমাস ওয়াইজ মহোদয়কে সম্পাদক করিয়া একটি কমিটি গঠিত হয়। কমিটি কলেজের বাটী তৈয়ার করিবার জন্য ইমামবাড়ী ও মহসীনের কবরের মধ্যবর্তী ভূমিখণ্ড মনোনীত করেন। ইতিমধ্যে ফরাসী General Peron ১৭৭৪ খৃঃ অব্দে ভারতে আসিয়া ব্যবসায় করিতে থাকেন এবং প্রভূত ধন সঞ্চয় করিয়া চন্দননগরের নিকটবর্তী বলিয়া চুঁচুড়ায় বাটী নির্মাণ করিয়া বাস করিতে থাকেন। General Peron এর বাসগৃহ (অধুনাতন কলেজ বিল্ডিং) তাঁহার চুঁচুড়া পরিত্যাগ করিবার সময় ‘প্রাণকৃষ্ণ হালদার ক্রয় করিয়া লন। তৎপরে প্রাণকৃষ্ণ হালদার ঋণজালে জড়িত হইলে চুঁচুড়ার প্রসিদ্ধ শীলবংশীয় জগমোহন শীল ঐ বাটী ক্রয় করেন। তাহার পর ১৮৩৬ খৃঃ জগমোহন শীলের নিকট

হইতে হুগলী কলেজ স্থাপন করিবার জন্য ২০,০০০ টাকায় ঐ বাটী ক্রয় করা হয়।”^২

এরপরের অংশে উঠে এসেছে কলেজের প্রস্তর ফলকে খোদিত কথাগুলি। তারপর বলা হচ্ছে— ‘Dr. Thomas Wise এই কলেজের প্রথম Principal হন।’ ডাক্তার ওয়াইজ তাঁর বিভিন্ন সামাজিক কর্মকাণ্ডের জন্য সেইসময় প্রসিদ্ধি লাভ করেছিলেন। এরপর অধ্যক্ষ হন সিভিল সার্জন Dr. James Esdaile। Caption D. L. Richardson, James Sutherland, Lionidus Clint, Robert Thwayates প্রমুখ অধ্যক্ষের নাম উল্লেখিত হয়েছে লেখাটিতে। সাহিত্যসম্রাট বঙ্কিমচন্দ্র চট্টোপাধ্যায়, অক্ষয়চন্দ্র সরকারের প্রসঙ্গ উত্থাপন করে বলা হয়েছে— ‘কে বলিতে পারে ভবিষ্যতে ইঁহাদেরই মত রত্ন এই কলেজ হইতে বাহির হইয়া বঙ্গভূমির মুখোজ্জ্বল করিবে কি না?’^৩ আমরা সকলেই জানি, বাঙালির হৃদয় ‘বঙ্গদর্শন’ একেবারে লুণ্ঠ করে নিয়েছিল। আর এই পত্রিকা প্রকাশের ক্ষেত্রে সম্পাদক বঙ্কিমচন্দ্রের সঙ্গে অগ্রণী ভূমিকায় ছিলেন অক্ষয়চন্দ্র সরকার। আলোচ্য লেখায় এই তথ্যটিকে বিশেষ গুরুত্ব দেওয়া হয়েছে। চুঁচুড়ার ‘স্থানীয় বিদ্যালয়’, ‘পুস্তকাগার’, ‘সাহিত্য চর্চা ও সাময়িক পত্র’, ‘সভা-সমিতি’, ‘চতুষ্পাঠী’, ‘হুগলী-চুঁচুড়া মিউনিসিপালিটি’ প্রভৃতি বিষয় উঠে এসেছে ইতিহাস অনুসন্ধানে।

এই পত্রিকায় মূলত প্রবন্ধ, গদ্য ও বিভিন্ন সংবাদ প্রকাশিত হয়েছে। কবিতা ও গল্পের উপস্থিতি খুবই কম। প্রথম বার্ষিক শ্রেণির ছাত্র গীষ্মতি ভট্টাচার্যের ‘গায়ত্রী’ কবিতার প্রথম স্তবক উদ্ধৃত করছি—

তোমার মত উদাস কর,
রুদ্ধ কর তোমার মত।
আপন তেজে আপনি জ্বলে’
বিশ্বহিতে সদাই রত।

বক্ষে তোমার বিপুল জ্বালা ;
অঙ্গে তোমার ব্যথার মালা ;
কণ্ঠ তোমার নীরব,
তবু, দৃষ্টি মুখের কত !^৪

ছয়টি কবিতায় বিন্যস্ত এই কবিতায় রবীন্দ্রপ্রভাব স্পষ্ট। তৃতীয় বার্ষিক শ্রেণির ছাত্র হাবিবুল হক লিখেছে গল্প; ‘অবসান।’ ‘পারসীকবি আমীরখোসরুর একটি গজলের অনুবাদ’ (নভেম্বর ১৯২৩-ফেব্রুয়ারি ১৯২৪) করেছে কলা বিভাগের প্রথম বর্ষের ছাত্র মোল্লা রবিউদ্দীন আহম্মাদ। কলাবিভাগের প্রথম বার্ষিক শ্রেণির ছাত্র জানকীবল্লভ ভট্টাচার্যের ‘অতি প্রাচীন ভারত’ (ফেব্রুয়ারি ১৯২৩) প্রবন্ধটি খুবই উন্নত মানের। ‘সীতারামে রমাচরিত্র’ (ফেব্রুয়ারি ১৯২৩) শীর্ষক প্রবন্ধ লিখেছে কলা বিভাগের তৃতীয় বার্ষিক শ্রেণির ছাত্র প্রমথনাথ বন্দ্যোপাধ্যায়। বিজ্ঞান বিষয়ের দ্বিতীয় বার্ষিক শ্রেণির ছাত্র নিমাইদাস পাল, H.W. Fitchett-এর ‘The Lady with the Lamp’ অবলম্বনে লিখেছিল প্রবন্ধ—

‘কুমারী ফ্লোরেন্স নাইটইঙ্গেল’ (সেপ্টেম্বর ১৯২৩)।

বিভিন্ন আকর্ষণীয় বিষয় নিয়ে সংক্ষিপ্ত প্রতিবেদন প্রকাশিত হত। প্যারিসের ‘Beggars’ Gazette’ নিয়ে লিখেছিলেন কৃষ্ণকমল দত্ত। ‘ম্যাকবেথ’-এর অংশবিশেষ অনুবাদ করেছেন কমলকৃষ্ণ ঘোষ। অধ্যাপক কমলকৃষ্ণ ঘোষের সহায়তায় ‘হিন্দুদিগের নাট্যশাস্ত্র’ (ফেব্রুয়ারি ১৯২৩) শিরোনামে অনুবাদ প্রবন্ধ লিখেছেন কলাবিভাগের তৃতীয় বার্ষিক শ্রেণির ছাত্র ভবতোষ ভট্টাচার্য। লেখার সঙ্গে সম্পাদকের মন্তব্য যুক্ত হতে দেখি। বিভিন্ন বিদ্যাচর্চার পরিসর গঠিত হয়েছিল ‘দি হুগলি কলেজ ম্যাগাজিন’-এ। কয়েকটি গুরুত্বপূর্ণ প্রবন্ধের উল্লেখ আমরা করছি—

রচনার শিরোনাম	রচনাকার	পত্রিকার সংখ্যা
General Features and Forms of the Novel with a short History of the Origin and Development of the English and the Bengali Novel	Prof. Kamal Krishna Ghosh	Vol II No 2, December 1920 P. 53-58
Religion of the Hymns	Prof. Bhagabat Kumar Goswami	Vol II No 3, April 1921 P. 103-110
Influence of Environment on the Writings of Sir Walter Scott	Prof. Kamal Krishna Ghosh	Vol II No 3, April 1921 P. 120-125
বিজ্ঞানে বিপ্লব : দেশ ও কাল সম্বন্ধে মানবের ধারণা (Einstein's theory of relativity)	কালীদাস ভট্টাচার্য	Vol II No 3, April 1921 P. 141-145
Shakespeare's Tragedies—can they be represented?—A reply to Charles Lamb	Prof. Kamal Krishna Ghosh	Vol III No 2, December 1921, P. 55-57
‘India’—from Economic Standpoint	Jitendra Nath Ghose	Vol III No 2, December 1921, P. 65-67
Baghdad	Principal R.B. Ramsbotham	Vol III No 3, March 1922, P. 97-98

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হুগলি কলেজ পত্রিকায় রবীন্দ্রপ্রসঙ্গ নিয়ে আলোচনায় আসা যেতে পারে। ফেব্রুয়ারি ১৯২৩ সংখ্যার শুরুতেই উদ্ধৃত হয়েছে রবীন্দ্রনাথের বাণী—

আমার কথা এই যে আপনারা এতগুলি যুবক আছেন, আপনাদের মধ্যে প্রবল শক্তি রয়েছে। আপনাদের কাছে কত বড় দাবী ; আপনাদের সকলের কাছে উপস্থিত— দেশের ভাষার দাবী, মানসজন্মভূমির দাবী। এটা ছোট জিনিষ নয় ; যা

অসম্পূর্ণ আছে, সেটাকে আমাদের চেষ্টায় সম্পূর্ণ করতে হবে।

—রবীন্দ্রনাথ, প্রেসিডেন্সি কলেজের ছাত্রগণের প্রতি। (প্রেসিডেন্সি কলেজ ম্যাগাজিন, নবেম্বর ১৯১৭)।^৬

এই সংখ্যার ‘সম্পাদকের ঝাঁপি’ লেখার সূচনায় ‘আজি বসন্ত জাগ্রত দ্বারে’ গানটি মুদ্রিত হয়েছে। বসন্ত-পঞ্চমীর দিনে ‘রবিবাবুর ফাল্গুনীর মত নাটক অভিনয় করাই উচিত’ বলে লেখক মনে

করেছেন। কেননা প্রতিটি উৎসবের দিনে সেই ভাবটিকে আত্মস্থ করতে হয়।

১৯২০ সালের ২৬ জুন লন্ডনের ইন্ডিয়ান স্টুডেন্টস হোস্টেলে আধুনিক ভারতের শিক্ষা নিয়ে বক্তৃতা দিয়েছিলেন রবীন্দ্রনাথ ঠাকুর। সে বক্তৃতায় উঠে এসেছিল তক্ষশিলা, নালন্দার প্রসঙ্গ। ভারতীয় শিক্ষাপদ্ধতির দিকে দৃষ্টি আকর্ষণ করেছিলেন তিনি। মডার্ন রিভিউ-এ প্রকাশিত একটি প্রতিবেদনের সারাংশের বিবৃত হয়েছে পত্রিকার ডিসেম্বর ১৯২০ সংখ্যায়।

১৯২১ সালের সেপ্টেম্বর মাসে রবীন্দ্রনাথের জোড়াসাঁকোর বাড়িতে ‘বর্ষামঙ্গল’ আয়োজন ও কবির বক্তব্যের নির্যাস প্রকাশ পেয়েছে ডিসেম্বর ১৯২১ সংখ্যায়। প্যারিস বিশ্ববিদ্যালয়ের অধ্যাপক, ভারততত্ত্ববিদ সিলভা লেভির শান্তিনিকেতনে যোগদানের সংবাদ ও প্রতি রবিবার স্নাতকোত্তর ছাত্রদের জন্য বিশেষ বক্তৃতার কথা উঠে এসেছে ডিসেম্বর ১৯২১ সংখ্যাতে।

শরদিন্দু গুপ্ত (বি.এ., ৩য় বার্ষিক শ্রেণী) ‘শিশু’ কাব্যগ্রন্থ নিয়ে ১৯২১ সালের এপ্রিল সংখ্যায় মনোজ্ঞ আলোচনা করেছেন।

কবিগুরুর বিদেশভ্রমণের বিভিন্ন বিবরণের সঙ্গেই আমরা পাই আচার্য জগদীশচন্দ্র বসু, প্রফুল্লচন্দ্র রায় প্রমুখ বিখ্যাত ব্যক্তিত্বের কর্মকাণ্ড ও সভাসমিতিতে তাঁদের বক্তব্যের প্রসঙ্গ। দেশাত্মবোধ ও নৈতিকতার ভাবনা ছাত্রদের মনে জাগ্রত করার তাগিদ স্পষ্ট হয়ে ওঠে পত্রিকার সামগ্রিক বিন্যাসে।

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তৎকালীন বাংলার শিক্ষাব্যবস্থা সম্বন্ধে বিভিন্ন তথ্য পাওয়া যায় আলোচ্য পত্রিকা থেকে। ডিসেম্বর ১৯২০ সংখ্যায় প্রকাশিত একটি প্রতিবেদনে East India Association-এ ঢাকা বিশ্ববিদ্যালয়ের উপাচার্য ড. হার্টগের ‘The Work of the Calcutta’ শীর্ষক গবেষণাপত্রের কথা উল্লেখিত হয়েছে। ভারতের শিক্ষার ক্ষেত্রে ‘Caste’, ‘purdah’, ‘pay and social position of teachers’, ‘medium of instruction’, ‘the examination systems’ ও ‘economic pressure’-এর প্রসঙ্গ উঠে এসেছিল লেখায়।

দেশের বিভিন্ন বিশ্ববিদ্যালয়ের সমাবর্তন অনুষ্ঠান নিয়ে নিয়মিত সংবাদ প্রকাশিত হত। গোপালচন্দ্র ভট্টাচার্য্য একটি ইংরেজি প্রবন্ধ অবলম্বনে লিখেছিলেন ‘বিদেশী বিশ্ববিদ্যালয় বার্তা’ (সেপ্টেম্বর ১৯২৩)। অক্সফোর্ড, কেম্ব্রিজ, হার্ভার্ড বিশ্ববিদ্যালয়ের ইতিহাস, শিক্ষাপদ্ধতি ও বৃত্তির ব্যবস্থা সম্পর্কে সেখানে প্রাঞ্জলভাবে আলোচনা করা হয়েছিল।

‘দি হুগলী কলেজ ম্যাগাজিন’-এর ‘Notes and News’, ‘About Ourselves’ বিভাগ থেকে প্রশাসনিক কর্মকাণ্ড সম্পর্কে জানতে পারি। অধ্যক্ষদের বদলির সংবাদ, শারীরিক অবস্থা, শ্রদ্ধাভরণ নিয়মিত প্রকাশ পেত। প্রফেসর বিপিনবিহারী সেনের মৃত্যুসংবাদ জানিয়ে শুরু হয়েছে ডিসেম্বর ১৯২০ সংখ্যা। এগারো বছর তিনি হুগলী কলেজে ইতিহাস বিভাগে অধ্যাপনা করেছেন। অধ্যক্ষ জে.এন দাশগুপ্তের মৃত্যুসংবাদ প্রকাশিত হয়েছে ডিসেম্বর ১৯২১ সালে (বর্ষ ৩ সংখ্যা ২)। ১৯০৬-১৯০৮ পর্যন্ত তিনি হুগলী কলেজের অধ্যক্ষ ছিলেন। ১৮৮৬ খ্রিস্টাব্দে ‘first State Scholar’ অক্সফোর্ডে যান। ১৮৯১ সালে দেশে ফিরে এসে ঢাকা কলেজে ইংরেজি ও ইতিহাসের অধ্যাপক হন। ১৮৯৬ খ্রিস্টাব্দে তিনি বদলি হয়ে আসেন প্রেসিডেন্সি কলেজে। তাঁর দুটি গুরুত্বপূর্ণ সারস্বতকর্ম হল—‘Bengal in the 16th Century’, ‘India in the 17th Century’

হুগলী কলেজের প্রিন্সিপাল মিস্টার ই.এফ.ওটেন ১৯২১ সালে বাংলার Assistant Director of Public Instruction পদে যোগদান করেছিলেন। কৃষ্ণনগর কলেজ থেকে বদলি হয়ে তারপর নতুন অধ্যক্ষ হিসেবে যোগ দেন মিস্টার আর.এন. গিলক্রিস্ট। ১৯২১ সালের ২১ ফেব্রুয়ারি মাসাধিক কাল বন্ধ থাকার পর কলেজ খোলে।

কলেজ ম্যাগাজিনের আলোচনায় ছাত্রদের কথা আসবে এটাই স্বাভাবিক। ১৯০৮ সালে কলেজের ছাত্রসংখ্যা ছিল ১৪৯, ১৯১৪ সালে ধীরে ধীরে সেটি হয়েছিল ২১৩। ১৯২০ সালে সেই সংখ্যা দাঁড়ায় ২৫৫। কিন্তু তারপর সেই সংখ্যা কমে যায়। আর্থিক অসচ্ছলতা, মহামারির প্রভাব এর মূলে ক্রিয়াশীল ছিল। পরপর দু-বছর সরস্বতী পূজো হয়নি। কেননা সেসময় স্মল পক্স মারাত্মকভাবে

ছড়িয়ে পড়েছিল। প্রত্যেক বছর যারা পদকলাভ করত ও গুরুত্বপূর্ণ পদক পেত, তাদের নাম প্রকাশিত হত।

হুগলি মহসিন কলেজ অ্যাসোসিয়েশনের পক্ষ থেকে বিভিন্ন সমাজসেবামূলক কর্মকাণ্ডের কথা জানতে পারি। ১৯২০ সালে বন্যাপীড়িত মেদিনীপুরে সাহায্য করবার জন্য বাড়ি বাড়ি ঘুরে ত্রাণ সংগ্রহ করেছিল ছাত্রেরা। গানের দল সারা সপ্তাহ ধরে শোভাযাত্রা করে ৮২০ টাকা যোগাড় করেছিল। বাবু সৌরেন্দ্রনাথ মিত্র, যোগেন্দ্রলাল চৌধুরী, নরেন্দ্রনাথ আদিত্য, মহেন্দ্রলাল শীল, পান্নালাল শীল, বৃন্দাবন চন্দ্র দত্ত প্রমুখ এই সেবাকার্যে উল্লেখযোগ্য আর্থিক সাহায্য করেছিলেন। মেদিনীপুরের তৎকালীন জেলাশাসক A.C. Cook ছাত্রদের ধন্যবাদ জ্ঞাপন করে চিঠি লিখেছিলেন এবং সেটি মুদ্রিত হয়েছিল ১৯২০ সালের ডিসেম্বর সংখ্যায়। একই বছর ৭ নভেম্বর, মাননীয় অধ্যক্ষ কয়েকজন ছাত্রকে নিয়ে বাঁশবেড়িয়ায় যান এবং গ্রামবাসীদের ম্যালেরিয়া, কলেরা, স্মল পক্স প্রভৃতি রোগ সম্পর্কে সচেতন করেন।

হুগলি কলেজের খেলাধুলো বিষয়ক প্রতিবেদনগুলি বিশেষ উল্লেখের দাবি রাখে। কোনো কোনো সংখ্যায় ক্রিকেট ম্যাচের স্কোরকার্ড মুদ্রিত হয়েছে। এপ্রিল ১৯২১, (বর্ষ ২ সংখ্যা ৩) জানতে পারি, আর্থ ক্রিকেট শিল্ড প্রতিযোগিতায় চুঁচুড়া স্পোর্টিং ক্লাবকে সেমিফাইনালে হারিয়েছিল কলেজ টিম। কিন্তু ফাইনালে মাত্র চার রানে হেরে গিয়েছিল চুঁচুড়া টাউন ক্লাবের কাছে। কে. জাকারিয়ার লেখা থেকে প্রাসঙ্গিক অংশ উদ্ধৃত করা যেতে পারে—

Till a few years ago, however, almost the only games students could play were football, cricket and hockey. In these the College could generally raise good teams. In 1922-23, for instance, the College won the Gladstone, Griffith and Suresh Modak cups in football, won six, drew three and lost only one match in cricket and lost only a single game in hockey.

(৫)

১১ ডিসেম্বর ‘দরবার ডে’ পালিত হত। বেশিরভাগ বছর এই দিনটিতে অনুষ্ঠিত হত ক্রীড়া প্রতিযোগিতা।

১৯২১ সালের ১০ ডিসেম্বর Studentós Debating Club-এর তৃতীয় অধিবেশনে সভাপতিত্ব করেছিলেন অক্ষয়কুমার সরকার। ‘দ্য হুগলি কলেজ ইউনিয়ন’-এর চতুর্থ অধিবেশনে ‘বিরাজ বৌ’ প্রবন্ধ পাঠ করেছিলেন, যা মুদ্রিত হয়েছিল মার্চ ১৯২২ সংখ্যায়। আলোচনায় অংশ নিয়েছিলেন প্রফেসর হেমচন্দ্র ব্যানার্জী। সভাপতিত্ব করেছিলেন তৎকালীন অধ্যক্ষ Mr. R.B. Ramsbotham। ১৯২২ সালের ২০ ফেব্রুয়ারি পঞ্চম অধিবেশনে প্রফেসর কমলকৃষ্ণ ঘোষ বক্তব্য রাখেন। বিষয়— ‘A comparative study of Ayesha and Rebecca’। একজন ছাত্র আলোচনায় অংশগ্রহণ করেন। সভাপতি ছিলেন সহকারী অধ্যক্ষ এস.সি.দে। শুধু সাহিত্য নয়, বিভিন্ন বিষয় নিয়ে নিয়মিত আলোচনা হত কলেজে। নারীদের ভোটাধিকার নিয়ে বিতর্কসভা অনুষ্ঠিত হয়েছিল। প্রতিবেদনের শেষটুকু মনে রাখবার মতো— “...What Hooghly College was thinking that day, all Bengal would think the next day.”

উপনিবেশের সময়পর্বে কোনো সরকারী কলেজ থেকে প্রকাশিত ম্যাগাজিনে শাসকের বিরুদ্ধ স্বর সচরাচর থাকবে না বলাই বাহুল্য। তবে অধ্যাপকদের লেখায়, ‘সম্পাদকের ঝাঁপি’তে, স্বদেশব্রতের দীক্ষায় ব্রতী করে তোলবার আন্তরিক তাগিদ অনুভূত হয়। আমাদের যতটুকু অনুমান, ১৯১১ সালের পরে হুগলি কলেজের ছাত্ররা স্বাধীনতা আন্দোলনে যোগ দিয়েছিল। ঐতিহাসিকদের তথ্য অনুযায়ী, ১৯২২ ও ১৯২৮ সালে কলেজে কিছু অস্থিরতা সৃষ্টি হয়েছিল। তবে উল্লেখযোগ্য হিংসার ঘটনা ঘটেনি। মার্চ ১৯২২ সংখ্যা থেকে জানা যায়, কলেজ হোস্টেল থেকে মাননীয় অধ্যক্ষের কাছে কয়েকটি চরকা চাওয়া হয়েছিল। সেই আবেদন মঞ্জুর হয়। অবসর সময়ে ছাত্ররা চরকা কাটত।

পরিশেষে বলতে হয়, ‘দি হুগলী কলেজ ম্যাগাজিন’-এর সূচনাপর্বের কয়েকটি সংখ্যাই কেবলমাত্র আমরা পেয়েছি। ইংরেজি বিভাগের অধ্যাপক কমলকৃষ্ণ ঘোষের সুযোগ্য সম্পাদনার প্রশংসা করতেই হয়। সেপ্টেম্বর ১৯২৩ সংখ্যায় তাঁর কর্তে হতাশা ব্যক্ত হয়েছে। যে বাণী প্রচার করতে

‘দি হুগলী কলেজ ম্যাগাজিন’ : ফিরে দেখা

চেয়েছিলেন, ‘সে বাণীর মর্ম্ম বুঝিবার শক্তি অধিকাংশেরই নাই।’ পত্রিকা প্রকাশের ক্ষেত্রে আর্থিক সমস্যা ছিলই। উন্নতমানের লেখারও অভাব দেখা গিয়েছিল বলেই অনুমান করা চলে। একইসময়ে ‘The Serampore College Magazine’ প্রকাশিত হত, যা তুলনায় অনেক বেশি সমৃদ্ধ। সে অবশ্য ভিন্ন প্রসঙ্গ।

বিভিন্ন সারস্বত প্রতিষ্ঠানের পত্রিকাগুলি নিয়ে ধারাবাহিক আলোচনা বাঙালির আত্মপরিচয়কে অনন্য মাত্রা দান করতে পারে বলেই আমাদের বিশ্বাস। এই নাতিদীর্ঘ প্রবন্ধের ইতি টানছি পত্রিকার ‘Notes’-এর অংশবিশেষ উদ্ধৃত করে— ‘The oldest institution of its kind in Bengal,

the Hooghly College has been a training ground for the makers of modern Bengal, its literature and Culture, its ideas and ideals. Bankim and Dinabandhu, Runglal and D.L. Roy have made the Hooghly College hall and the Hooghly College library Sacred places of pilgrimage to all lovers of modern Bengal. Well may every one of us say with Principal Bose and say with pardonable pride, “Hugli College with me is a name to conjure with and will remain so till the end of my days.”^৭

তথ্যপঞ্জি—

১. 'History of Hooghly College 1836-1936', K. Zakariah, Superintendent, Government Printing Press, Alipore, Bengal, 1936, Page 118
২. ‘চুঁচুড়ার সংক্ষিপ্ত ইতিবৃত্ত’, লেখকের নাম অনুজ্জিত, ‘দি হুগলী কলেজ ম্যাগাজিন’, বর্ষ ২ সংখ্যা ২, ডিসেম্বর ১৯২০, পৃ ৯৫
৩. ‘চুঁচুড়ার সংক্ষিপ্ত ইতিবৃত্ত’, পূর্বোক্ত, পৃ ৯৬
৪. গীষ্মতি ভট্টাচার্য্য, ‘গায়ত্রী’, “দি হুগলী কলেজ ম্যাগাজিন”, বর্ষ ৩ সংখ্যা ২, ডিসেম্বর ১৯২১, পৃ ৮৭
৫. 'THE HOOGLY COLLEGE MAGAZINE', VOL IV, No 2, February 1923, P. 1
৬. 'History of Hooghly College 1836-1936', Ibid, P. 119
৭. 'Notes', 'THE HOOGLY COLLEGE MAGAZINE', VOL II, No 2, December 1920, P. 77

Health Status of Women in India: Determinants, Challenges

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Abstract

Women face various unique health issues as compared to men. From the very beginning of adolescent period, a young girl is subject to various social and cultural constraints along with gender discrimination in food and education. Deficiency of essential micronutrient and inadequate dietary intake of women at reproductive age creates intergenerational problems. Early marriage and child birth poses serious threats to health of women which creates long period trauma to the women and to the family also. Women's health is influenced by a complex interaction of physiological, nutritional, social and cultural factors throughout the life cycle. In India, women face several health challenges including anaemia, malnutrition, reproductive health disorders, maternal morbidity, osteoporosis, menstrual abnormalities and increasing incidence of non-communicable diseases. Inadequate nutrition, poor hygiene, low educational attainment and limited access to healthcare services further aggravate these health problems. This review examines the major determinants affecting women's health in India and highlights their physiological consequences. The paper emphasizes the need for improved nutrition, reproductive healthcare, health awareness and gender-sensitive interventions to enhance the overall health status and quality of life Indian women.

Keywords: Women health, nutrition, social and cultural, healthcare.

Introduction:

The health of Women in India is inherently connected to the gender norms and patriarchal characteristics of the Indian society [1]. The interplay of societal and environmental factors is crucial determinants of health. However, women's health is neglected by their family from the very beginning as they are unwanted in a male preferred social system. The fact is clear from the son preference attitude of parents and the incidence of female infanticide is still prevailing in India [2]. In 2011, the sex ratio was 943 females per 1000 males and early marriage and child-birth is a major detrimental factor of women's health [3]. Exploration of NFHS-5 data (2019-21) reveals that around 54 percentages of women of age group 18-45 are anaemic. Apart from food habits and iron deficiency it has been explored that the socio-economic determinants influencing the incidence of anaemia among Indian women. In 2005, when the National Rural Health Mission was launched by the Ministry of Health and Family Welfare (MoHFW), Government of India, the MMR of the country stood at 254 per 100,000 live births. In the last Sample Registration Survey report of 2017, MMR of India stands at one hundred twenty two per 1

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lakh live births. Only 30.3% of pregnant mothers reported consuming iron tablets as prescribed, and a meagre 21% of mothers reported having received full antenatal care. Data from India's fifth National Family Health Survey (NFHS-5) shows meagre success in key maternal and child health and nutrition indicators over the five years[4]. The demographic consequence of neglecting women health results in various detrimental issues such as, low birth weight babies, low sex ratio, maternal death, low female education, low participation in economic activities as compared to men. Poor health status of women causes serious health threats for the families also. Women with low body mass index and nutritional deficiency results in low weight infants and also with neo natal complications. Moreover an unhealthy woman fails to provide adequate care and nutrition to her children, this creates an intergenerational cycle of poor health in families. Thus a wide range of factors segregating to bio-demographic, socio-economic and cultural that are influencing women health status in India. Now we will go through some of past studies based on the exploration of the factors influencing women health in India.

Current Knowledge and Research

Evidence:

Several studies explored various bio-demographic as well as socio economic factors which are primarily responsible for poor health status of women in India. Women's health status is influenced by the dynamic interplay of biological, social, and cultural factors [5]. Indian women from low-income groups consume diets that have inadequate calcium coupled with too few calories, proteins and micronutrients [6]. Hospital based data suggest that women have osteoporotic hip fractures at a much earlier age than Western women as observed by Shatrughna et al.(2005). Moreover, these women are underweight, and they attain menopause at an earlier age [7]. So It is possible that these women are at a greater likelihood of having osteoporosis and fractures at an early age [8, 9]. Cultural and

social factors impose significant importance for women health status. A case study in a tribal district of Jharkhand revealed that female headed households are more vulnerable to nutritional insecurity, as they often face obstacles related to food starvation and food procurement [10, 11]. The prevalence of female sexual dysfunction is much higher because Indian women are suppressed, self conscious and hesitant to talk about their sexual problems with health care professionals as observed by Jain et al.(2019) [12]. The literacy level of women can affect reproductive health, use of contraceptives, health and development of children, proper hygienic practises, access to jobs and the overall status of women in the society. Early marriage and childbirth is a major determinant of women's health [13]. However employed women are at more risk of being the victim of abuse and violence. According to Buckshee, Maternal morbidity and mortality has multiple causes and it creates serious threats to the new born also. Due to the lack of proper prenatal care, clean and safe delivery with trained assistance, proper units for handling pregnancy complications and inadequate postpartum care leads to death of mother during childbirth is a common phenomenon in India. Exclusive use of hygienic methods like sanitary napkins, locally prepared napkins and menstrual cups to prevent the visibility of bloodstains during menstruation is still considerably low among adolescent women in rural India [14]. Young girls who are victim of child marriage without proper sex education and less autonomy for own health care are more susceptible to the danger of having STI, genital sore and complicated pregnancies. In India women have less autonomy for abortion also. Women with lower BMI combined with stunting and wasting leads to undernourished women who are more likely to give birth to undernourished babies, continuing an intergenerational cycle of malnutrition [15]. Among other illnesses the incidence of breast cancer is the most common now days, with an age-adjusted rate of 25.8 per 100,000 women [16]. Apart from that, menstrual issues such as menorrhagia,

endometriosis and polycystic ovarian disorder have been increasing over time. Different culture, religion, caste category and customs severely impacts women health status in India. Tribal women are more vulnerable to under nutrition as compared to women from any other caste as observed by Rao et al. [17]. The percentage of anaemic women is more among the OBC and schedule tribe than general caste as observed from NFHS-5 data [18]. Caste wise inequality towards women health is explored by many researchers. From NFHS-3 data it was found that SC, ST women and children are at greater risk of neonatal and infant mortality [19]. Sharma et al. explored that pregnant and lactating women had low-mixed vegetarian dietary patterns, which were greatly influenced by religion and areas of residence, using data of 476 pregnant and 446 lactating women from India [20]. The situation of postpartum mothers is also at an alarming position in India. Customs and traditional practices create serious implications on lactation and breastfeeding, and in the overall well-being and health of mothers and infants as opined by Bandyopadhyay. The author observed that cultural practice of avoidance of many nutritious foods and restrictive diet immediately after birth could affect the overall health of both the mother and her infant [21]. Distance to health facilities continues to be a logistic barrier for most of the Indian women along with getting money for treatment at the household level [22]. Healthier women and their children contribute to more productive and better-educated societies and it confirms that women's health is tied to long-term productivity of any nation [23]. Studies found that maternal mortality has a statistically significant negative effect on GDP [24]. Hence the importance of women health is undoubtedly requires urgent and immediate attention of policy makers.

So, we observed a wide range of factors that are responsible for women health status in India. The diagram given below summarize the major factors determine women health status in India.

Research question:

Based on the review of the above literatures, here we focused on the question that, to what extent the socio-cultural and socio-economic factors besides the bio-demographic factors are significantly influencing women health status in India? And how far the stereotypic gender norm issue is influencing the nutrition and overall health status of Indian women?

Objective of the study:

The objective of this review was to describe the evidence in terms of socio-economics and cultural determinants, besides the physiological reasons, affects the overall health status of women in India.

Contribution of the present study:

Beside the physiological factors, such as, cardiovascular and metabolic health indicators, the socio-cultural, demographic, socio-economic factors and gender inequality play significant role for health status of women. Based on the literatures reviewed above we believe that these factors are not so well addressed in a compact manner along with the physiological health indicators. Hence, the present study will attempt to gauge the range of various socio-economics and socio-cultural factors along with bio-demographic factors that are crucially affecting the health outcome of women in India.

Methodology:

We did a systematic review of quantitative and qualitative studies on women in India to examine effects on women health and to identify the factors, which are the prime barriers to achieving sound health outcomes apart from food habits and basic health care,. We searched from Google scholar and various electronic databases were used for current information related to sex ratio, maternal health data. Published articles are included, from 2025 to 1983 measuring women health determinants and health outcomes from India. The search was conducted by the first author.

The Next table reflects the primary health indicators of women in India over the time period of 2019-21 to 2023-2024. Here

Health Status of Women in India: Determinants, Challenges

we have considered BMI, blood pressure, level of blood sugar and use hygienic methods of protection during their menstrual period.

Data:

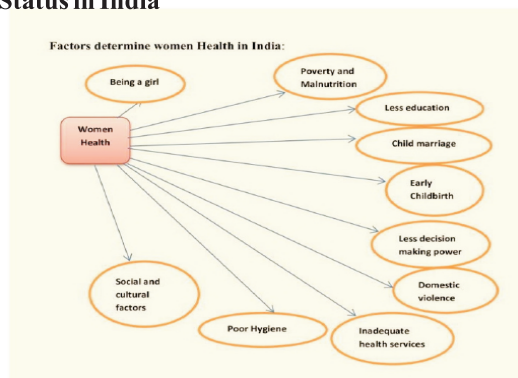
For descriptive statistics we have used NFHS (National Family Health Survey) data set.

Factors Determining Women's Health in India

- **Girl Child (Gender Discrimination)** – Gender bias often discriminates access to nutrition, education, and healthcare from childhood.
- **Child Marriage** – Child marriage is associated with premature pregnancy and childbirth.
- **Early Childbirth** – Adolescent pregnancy increases maternal and infant morbidity and mortality.
- **Domestic Violence**: It is also associated.
- **Poverty and Malnutrition** – It is associated with inadequate nutrition, poor living conditions.
- **Less Decision-Making Power** – Limited autonomy in house and health-related decisions restricts women's ability to take timely healthcare.
- **Less Education** – Low literacy levels reduce awareness regarding hygiene, nutrition, reproductive health.
- **Inadequate Hygiene** – Lack of sanitation facilities and poor menstrual hygiene leads to various infections and diseases.

Inadequate Health Services – It is very significant that quality healthcare services highly impact women's health outcomes.

Figure 1: Factors determine Women health Status in India



Source: Author's own drawing

Table1: Health Status of Women in India over time (2019 -2024) at a Glance

Nutritional Status of Women (age 15-49 years)	NFHS-6 (2023-24) (all India total) (%)	NFHS-5 (2019-21) (all India total) (%)
Women whose Body Mass Index (BMI) is below normal ((BMI<18.5 kg/m ²)(%)	19.7	18.7
Women who are overweight or obese (BMI ≥25.0 kg/m ²) (%)	30.7	24.0
Blood sugar level - high (141-160 mg/dl) (%)	7.5	6.1
Elevated blood pressure (Systolic ≥140 mm of Hg and/or Diastolic ≥90 mm of Hg) or taking medicine to control blood pressure (%)	19.4	21.3
Women age 15-24 years who use hygienic methods of protection during their menstrual period (%)	79.2	77.6

Source: Author's own findings from NFHS data

From the above table we observe that the percentage of women who are overweight or obese has increased to 30.7 % in 2023-24 from 24.0% in 2019-21. More incidence of high level of blood sugar among Indian women has been recorded in 2023-24. Around 7.5 % of Indian women recorded elevated level of blood sugar in 2023-24 than from 2019-21 when it was 6.1%. A minimal decrease in percentage of women having elevated blood pressure is observed in 2023-24 (19.4%) than from 2019-21(21.3%).

From the above table we observe that the percentage of woman having elevated blood sugar, having high level of blood pressure and who are overweight is more in urban India than in Rural areas. However more percentage of women are underweight in rural India than Urban. The next diagrams, drawn on the basis of the dataset used in Table 1 and in Table 2, describe the overtime change in women health Status in India (2019-2024).

Table 2: Health Status of Women in India (Rural-Urban comparison over time (2019-2024) at a Glance

Nutritional Status of Women (age 15-49 years)	NFHS-6 (2023-24)	
	Urban (%)	Rural (%)
Women whose Body Mass Index (BMI) is below normal ((BMI < 18.5 kg/m ²)(%))	13.2	22.5
Women who are overweight or obese (BMI ≥ 25.0 kg/m ²) (%)	42.8	25.5
Blood sugar level - high (141-160 mg/dl) (%)	8.0	7.3
Elevated blood pressure (Systolic ≥ 140 mm of Hg and/or Diastolic ≥ 90 mm of Hg) or taking medicine to control blood pressure (%)	23.5	17.8
Women age 15-24 years who use hygienic methods of protection during their menstrual period (%)	90.7	75.0

Source: Author's own findings from NFHS data

Fig 2: BMI of Indian women at a glance: Comparison overtime (2019-21 and 2023-24)

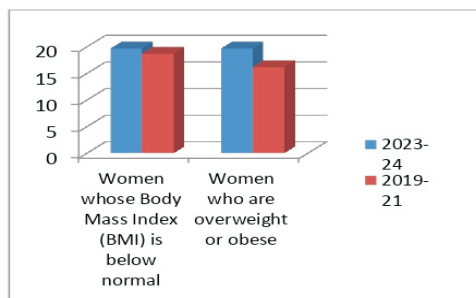


Fig3: Blood sugar level of Indian women at a glance: Comparison overtime (2019-21 and 2023-24)

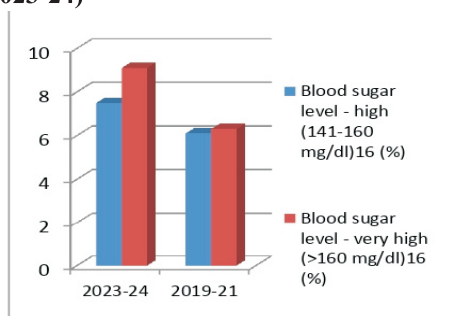


Fig 4: Level of Blood Pressure of Indian women at a glance: Comparison overtime (2019-21 and 2023-24)

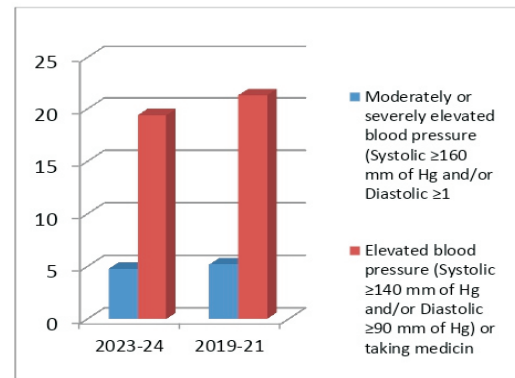


Fig 5: Usage of hygienic methods of protection during menstrual period (Rural-Urban Comparison (2023-24)

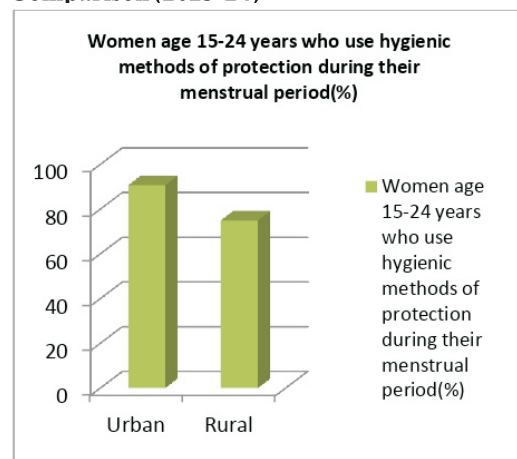
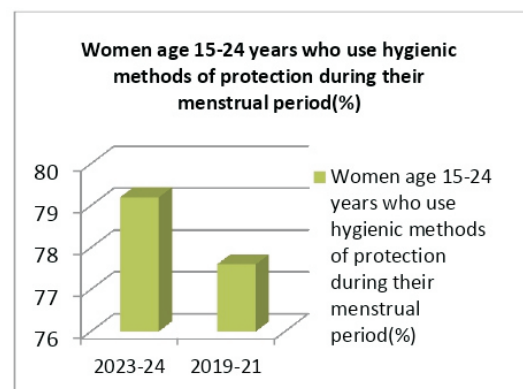


Fig6: Usage of hygienic methods of protection during menstrual period comparison over two time periods (2019-21 and 2023-24)



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Conclusion and Policy Implication:

Women are deprived of basic health care and nutrition due to several factors. Healthy food habits and adequate intake of nutrients essential for women health must be addressed immediately by the planners. Gender inequality and attitude towards women is the most crucial constraint to the health status of women. Cardiovascular diseases are also more common in women compared to men, due to inadequate access to healthcare services. Women herself place them in the backseat in terms of their own health care and give more attention to the health of other members of the family, the fact is common in a deep rooted patriarchal society. Better

nutrition, education and access to healthcare services should be free from any type of gender biases. Government policies must focus on improving the literacy rate and quality education among women. Beside that Government must create adequate employment opportunities for women, which might explore positive impact on the women's health concerns. Also there is an urgent need to improve the dietary habits of pregnant and lactating women amidst considerable socio-cultural and economic influences. Government Programmes and Campaign on hygienic habits among women, practice of safe sex, awareness about access to health care services during pregnancy and delivery can improve the health status of women.

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Impact and Influence of Lalon Shah on Rabindranath Tagore : Revisited

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Abstract: Lalon Shah (1774-1890) is regarded as an important and prominent figure of Folk philosophy and culture. His philosophy mesmerizes people of different countries equally. “UNESCO of United Nations declared Baul song 'A masterpiece of the Oral and Intangible Heritage of Humanity' in 2005. This is why Lalon the pioneer of Baul philosophy has become the most curious subject to foreign readers.”¹ Lalon's songs bear great philosophical significances. He was a preacher of Humanism and laid importance on humanity at large. Lalon Shah is undoubtedly a significant figure in the history of Bengal who through his songs stood against Caste system and all sorts of social evils. LalonShah remains relevant in all ages across globe. In this research paper, attempt will be made to revisit the impact and influence that Lalon Shah has had on Rabindranath Tagore. The author has tried to trace the line of similarities between the philosophy of Lalon and Tagore. It is believed that Rabindranath Tagore was deeply influenced by Lalon. This work explores the areas of influence. Lalon Shah and Rabindranath Tagore, despite coming from different backgrounds and belonging to different time frame had a lot in common in their philosophy and artistic expression.

Keywords: Lalon Shah, Haramoni, Monermanush, Jeevandevata, Baul

Introduction:

Lalon Shah is considered as a great personality of Folk tradition. “Little is known about the personal life of Lalon Shah. He was born probably at village Harishpur in

Jhenaidah district, variantly, in a Kayastha family of Bhadra village in Kumarkhali of Kushtia district.”² There is a lot of controversy regarding his caste, religion and place of birth. He himself vehemently opposed caste system. There is also difference of opinion with regard to whether Lalon is a baul or a fakir. Many researchers have mentioned Lalon as Baul but we hardly find any instance in Lalon songs where he called himself a Baul on the contrary he described him as a fakir. Lalon was initiated in fakiri mat and SirajSai was his Guru. He was nurtured in the fakiri environment and culture for a long time and adopted the virtues of a fakir so why should we hesitate calling him a fakir.³ Commoners often use the terms Baul and Fakir interchangeably so we may designate him as a forerunner of Baul-fakir tradition, without going into much controversy. He was never interested in upholding his identity in public rather believed strongly in humanism. Tagore was deeply influenced by Lalon and Baul songs.

Discussions:

Songs by Lalon Shah have special religious and social significance and are also very good in terms of literary and musical quality. Rabindranath Tagore gave no hints that the traditional notion of his meeting with Lalon is wrong. His view on this matter is unclear and ambiguous. In the 'Ashirbad' section of *Haramoni*⁴ compiled by Md. Monsurruddin, Tagore opined that: When he stayed in Selaidaha, he always used to have meeting and discussions with Baul groups, in many of his songs he included baul music. But he never clearly said anything whether Lalon

was included in that group or not. In Prabashi Patrika from baisakh, 1322 (BS) for publication of Folksongs (Lokasangeet) a new section named Haramoni was introduced. The name haramoni signifies lost treasures of folk culture.

He had much admiration and love for Lalon who occupied an important position in his scope of study which is revealed through the fact that from Veda-Upanishad to Bible and Lalon's biography were there in his study table.⁵

We witness influence of Lalongeeti on Rabindrasangeet.

Lalon: *Amar gharer chabi parer hate
Kemne khuliya se dhan dekhbo choksete...*

Rabindranath: *Bhenge more gharer chabi
Niye jabi ke amare*

O bandhu amar!

*Na peye tomar dekha eka eka din je amar
katena re!...*

Rabindranath Tagore is a notable figure of Bengali literature. His widely acclaimed composition *Gitanjali* brought Bengali literature to the limelight and gave it an international foothold. Previously, though there were rich resources within Bengali literature and culture still it failed to gain its position in International world. We realize the influence of Lalon Shah's thoughts coinage and tune of songs in his *Gitanjali*. Lalon may have born in an ordinary rural family but he was a gifted son of undivided Bengal with a spiritual and philosophical bent of mind. He tried to create a different ideological tradition known as Lalondarśan that spoke for unity and equality at the then dark society which was totally broken by religious and caste divisions. From this time the Baul-Fakir tradition and movement started gaining force. As Lalon's songs were not preserved in written form due to Lalon's so called ignorance and passed orally, the songs may have been distorted to some extent. His

disciples and admirers tried to preserve the legacy of Lalon's songs through ages. Among the admirers and collectors of his songs the name of kaviguru Rabindranath Tagore is worth mentioning.

"Rabindranath Tagore collected a manuscript of Lalon's songs from Lalon's Akhda at Chheunriya and had 298 songs copied therefrom. He selected 20 songs out of them and got them published in four consecutive issues of the *Prabasi*".⁶ Six songs have been published in *Haramoni* by Md. Monsuruddin and there it is clearly written that these are collected by Rabindranath. He was mesmerized by the music and philosophical undertonings of the songs by Lalon, who had no formal education. Tagore admired Lalon's work and quoted the opening lines of one of Lalon's famous songs, "khancharvitorachin pakhi", in his Hibbert Lectures at Oxford. Many years ago, Tagore recognized the depth of Lalon's philosophy and shared it with the world. However after Lalon's death; we have not done a good job of spreading his philosophy globally. Hence despite its unique appeal, Lalon fakir and much of his philosophy remain unknown to the world.

Tagore was very much attracted to Baul music and many of his writings reflect that influence. Like Lalon, he also held the same view that God is nowhere outside; he resides inside the human body and the body is the temple of that living God. But ordinary man fails to realize that and search for God outside. We find that utterance in one of Tagore's songs:

*Amar hiyar majhe lukiye chile
dekhte ami paini tomay dekte ami paini
Bahir pane chokh melechi
Amar hridoye pane chaini...*⁷

In this regard, to quote a song of Lalon:

*Ei manushe sei manush ache
Kato muni rishi char yug dhore tare beracche
khunje
Jole jemon chnad dekha jaye
Dhorte gele hate ke paye*

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*Temni se thake soday
Ache aleke bose.*⁸

Tagore's interest for the life and songs of Baulsinfact developed to a large extent after coming in contact with GaganHarkara at Silaidaha. Love and Humanism form the core of the Baul philosophy. We find close parallels of Lalon's philosophy with that of Tagore. Rabindranath understood that the concept of monermanush as conceived by the Bauls is close to the idea of Jeevandevata. Tagore's goal was to make humans more divine and to bring God closer to natural experience. To him, the almighty expresses His ananda (Joy) in creation and that gets manifested in His created beings as well. Rabindranath believes that individual Joy lies in realization of God within one's soul.

*Tai tomar ananda amar 'par
Tumi tai esecho niche...*⁹

Tagore feels, this finite body is the receptacle of the Infinite Being. He writes,

*Simar majhe asim tumi
Bajao apon sur...*¹⁰

To Rabindranath, Love is a highest Virtue, which encompasses many other virtues and through Love we can realize the divinity within our finite existence. Similarly, for Lalon God resides within this mortal body. One strives to achieve union with this God, who is one's own monermanush.

Love is the best way to realize this unity. With a mind full of hatred, ill-feeling, conflict, the realization of the Supreme is not possible. Lalon through his numerous compositions has spread the message of unity, love and humanism. Lalon search for his 'monermanush' (paramātmān) within the mortal existence. Humanism was the greatest treasure of his ideological life. So he opined that the traditional religion create division within man. The essence of humanism is the union of man and Supreme Being.

One who can realize the essence of human religion can grasp the ultimate.

He said: *Dane veda bame koran, majhkhane
fakirer boyan
Jar hole sei dibyojnana sei dekhte paye.*

This theme resonates in Tagore in this way:

*Simar majhe asim tumi bajao apon sur
Amar modhye tomar prokash tai eto modhur.*

Here, Tagore believed that the almighty resides in the finite existence and this presence brings beauty in an individual. We fail to realize this presence and so act contrary to humanity. To Tagore, humanism is the ultimate religion. We often fail to realize the presence of the Supreme Being within us and our behaviour stands contrary to humanity.

Rabindranath:

*Rupsagare dub diyechi
Arup ratan asha kori
Ghate ghate ghurbona ar
Bhasiye amar jeerno tari
Somay jeno hoy re ebar
Dheu khayoa sab chukiye debar
Sudhay ebar toliye giye
Amar hoye robo mori.*¹¹

Lalon:

*Ruper tulona rupe
Phoni moni soudamini
Ki ar tar kache sobhe
je dekheche sei atal rup
bak nahi tar, mereche chup
par holo se e bhava rup
rupe mala hridoye jape.*¹²

Upanisad says 'Ātmānamviddhi' know thyself. Both Lalon and Tagore feel that we should know ourselves. One who knows oneself ultimately realizes the Absolute. The main theme of Lalon's philosophy is to realize oneself shunning off all sorts of egoism and greed, lust etc. He never preached any new 'ism' rather re-echoed the same simple facts already preached by many seers, avatars and great personalities. Lalon earnestly yearned for the union with the almighty.

Milon hobe kato dine/ amar moner manusher sone...

Similarly to get the divine touch, Tagore too became restless and wrote:

Jadi tomar dekha na pai prabhu ebar e jeebone

Tabe tomay ami paini jeno

Se katha roymone

*Jeno bhule na jai, bedona pai sayone swapane*¹³

OR

Amar milan lagi tumi

Ascho kabe theke

Tomar Chandra surjo tomay

Rakhbe kothay dheke

Kato kaler sakal snaje

Tomar charon dhoni baje

Gopone dut hridoya majhe

*Geche amay deke.*¹⁴

It is true that the songs of Lalon Shah and the Baul tradition had an influence on Tagore and his work, *Gitanjali*. Some of the songs of *Gitanjali* like: *Chai go amitomare chai* or *Rupsagare dub diyechior* Tai tomaranondoamarpor, reflect the influence. Although Tagore didn't directly borrow themes from Lalon's specific lyrics, he was deeply inspired by the Bauls' mystical and devotional way of looking at life. This is reflected in *Gitanjali*'s focus on devotion, love, and the longing for the divine. Tagore's poetic style and his spiritual exploration were also shaped by Lalon's songs. He became familiar with Baul music through GaganHarkara and was especially drawn to Lalon Shah's songs.

Gitanjali, which translates to "*Song Offerings*," explores the themes of devotion and the yearning for the divine, echoing the mystical nature of Baul songs. Tagore's own spiritual journey was significantly impacted by Lalon's songs, which contributed to his unique style of poetry.

Lalon Shah and Rabindranath Tagore, despite coming from different backgrounds, had

many similarities in their philosophy and artistic expression. They stressed the importance of inner spiritual realization and the search for the divine. They both explored themes like humanism, equality, and the presence of the divine in the world through their poetry and songs.

Both Lalon and Tagore believed in finding the divine inside oneself, which is a key idea in their traditions. Lalon's teachings ignored social differences and focused on searching for the soul, while Tagore looked at how the human soul can reach enlightenment. Both Lalon and Tagore played important role for changing society. Lalon's music didnot follow religious or class boundaries and encourage unity. Tagore's work also valued human relationships and showed that social and cultural differences don't matter when it comes to deeper truths. Lalon's ideas attacked the inequalities and injustices prevalent in the society and tried to build a just society. Tagore's writing and actions also aimed to fix social unfairness and create a fairer world. They believed everything in the world is connected and that the divine is part of everything.

Vaishnavism, Sufism and Buddhism, had great influence on both Lalon Shah and Rabindranath Tagore which made their ideas and art works very similar. They both followed the bhakti tradition, which is about love, devotion, and seeing the divine as one. Lalon's songs, especially those about love and self, match Vaishnava ideas of devotion and giving up ego. Tagore's poetry, even when it doesn't directly mention Vaishnavism, often talks about love and the divine, showing same influence. Lalon's Baul songs focus on mystical experiences and are influenced by Sufism, especially its ideas about the inner self and spiritual journey. Tagore's poetry also has Sufi themes, like love, union with the divine, and the search for truth. Both Lalon and Tagore were inspired by Buddhist ideas of compassion, humanism and equality.

Conclusion:

The whole discussion makes it clear that Tagore was deeply influenced by Lalon Shah

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and both shared many similarities. But it should not be apprehended that themes or some languages are directly taken from Lalon's songs, rather both drew ideas from many traditions like Vaishnavism, Buddhism, Sufism etc. which resulted in the similarities.

It is true that Tagore held Lalon and Baul songs in high esteem and was mesmerized by its philosophical nectars. In this critical world scenario, messages of Lalon and those of Tagore regarding humanism, equality and love seem very much relevant.

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কালিদাসের রচনায় বৈদিক ঐতিহ্যের প্রভাব ও প্রতিফলন : একটি অন্বেষণ

ড. গৌতম ভড়

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সারসংক্ষেপ

মহাকবি কালিদাস সংস্কৃত সাহিত্যের শ্রেষ্ঠ কবি ও নাট্যকারদের অন্যতম। তাঁর সাহিত্যকীর্তির মধ্যে রঘুবংশ, কুমারসম্ভব, অভিজ্ঞানশকুন্তল, বিক্রমোর্বশী, মালবিকাগ্নিমিত্র এবং মেঘদূত বিশেষভাবে উল্লেখযোগ্য। কালিদাসের রচনাবলির একটি গুরুত্বপূর্ণ বৈশিষ্ট্য হল বৈদিক সাহিত্যের গভীর প্রভাব। বেদ, ব্রাহ্মণ, আরণ্যক এবং উপনিষদে প্রতিফলিত ধর্মীয়, দার্শনিক ও সাংস্কৃতিক চেতনা তাঁর সাহিত্যে নানাভাবে প্রকাশিত হয়েছে।

কালিদাসের কাব্যে বৈদিক যজ্ঞ প্রথা, ঋষি-আশ্রমের জীবনযাত্রা, বর্ণাশ্রমব্যবস্থা এবং দেবদেবীর প্রতি শ্রদ্ধা বিশেষভাবে লক্ষণীয়। রঘুবংশ-এ রাজাদের অশ্বমেধ প্রভৃতি যজ্ঞসম্পাদনের বর্ণনা বৈদিক আচার-অনুষ্ঠানের পরিচায়ক। অভিজ্ঞানশকুন্তল-এ কণ্বঋষির আশ্রমের শান্ত, তপোবলসম্পন্ন পরিবেশ বৈদিক আশ্রম-সংস্কৃতির আদর্শ রূপকে তুলে ধরে। একইভাবে কুমারসম্ভব-এ দেবশক্তির মাহাত্ম্য, তপস্যার গুরুত্ব এবং ধর্মভাবনা বৈদিক আদর্শেরই প্রতিফলন।

কালিদাসের প্রকৃতি চিত্রণেও বৈদিক সাহিত্যধারার প্রভাব লক্ষ্য করা যায়। বৈদিক ঋষিদের ন্যায় তিনি প্রকৃতিকে চৈতন্যময় ও দেবত্বসম্পন্ন সত্তা হিসেবে উপলব্ধি করেছেন। নদী, পর্বত, বৃক্ষ, ঋতুচক্র এবং প্রাণিজগতের সঙ্গে মানবজীবনের নিবিড় সম্পর্ক তাঁর কাব্যে সুস্পষ্টভাবে প্রকাশিত হয়েছে। তদুপরি, সত্য, তপস্যা, ধর্মনিষ্ঠা, কর্তব্যবোধ এবং লোকমঙ্গলচিন্তা প্রভৃতি বৈদিক জীবনমূল্য তাঁর সাহিত্যকে সমৃদ্ধ করেছে।

অতএব বলা যায় যে, কালিদাস কেবল বৈদিক উপাদান গ্রহণ করেননি—বরং সেগুলিকে কাব্যিক কল্পনা ও নান্দনিকতার মাধ্যমে নতুন রূপ দান করেছেন। এই সমন্বয়ই তাঁর সাহিত্যকে চিরন্তনতা প্রদান করেছে এবং সংস্কৃত সাহিত্যে তাঁকে এক অনন্য উচ্চতায় প্রতিষ্ঠিত করেছে।

Key Words : কালিদাস, বৈদিক সাহিত্যধারা,

বর্ণাশ্রমব্যবস্থা, ঋষি-আশ্রম সংস্কৃতি, বৈদিক জীবনমূল্য।

মূল প্রবন্ধ : মহাকবি কালিদাস সংস্কৃত সাহিত্যাকাশের দীপ্তিমান সূর্যস্বরূপ। তিনি বিশ্ববিখ্যাত কাব্যশ্রষ্টা, কবিকুলগুরু, সফল মহাকাব্যকার, সর্বশ্রেষ্ঠ নাট্যকার এবং উৎকৃষ্ট গীতিকাব্যের প্রণেতা। তিনি কেবল সংস্কৃত ভাষারই নন, সমগ্র মানবসমাজের সাহিত্যিক সমৃদ্ধির অন্যতম শ্রেষ্ঠ প্রতিনিধি। মহাকবি কালিদাস ভারতীয় সংস্কৃতির এক মহান ব্যাখ্যাতা। তাঁর কাব্য যেন এক ত্রিবেণীসঙ্গম। সেখানে কবিত্বের নির্মল ধারা পবিত্র মন্দাকিনীর স্রোতের ন্যায় প্রবাহিত হয়েছে। ভাব ও কল্পনার গভীর ধারা মনোরম কালিন্দীর প্রবাহের সমতুল্য। আবার বিভিন্ন কলা, জ্ঞান এবং নবনব সৃষ্টিশীল প্রতিভারূপিনী সরস্বতীর শুভ্রধারাও তাতে সঞ্চারিত হয়েছে। তাঁর কাব্যে স্বর্গীয় আনন্দ, পার্থিব সৌন্দর্য, দৈবিক মহিমা, মানবিক মনোমুগ্ধকরতা এবং সাদৃশ্যিক মোহময়তা বিদ্যমান। তাঁর কাহিনিগুলিতে সুপরিপক্কিত ঘটনাবিন্যাস দেখা যায়। সেখানে বাহ্যপ্রকৃতির বিশ্লেষণের পাশাপাশি অন্তঃপ্রকৃতিরও সূক্ষ্ম উপলব্ধি প্রকাশ পেয়েছে। চরিত্রচিত্রণে ব্যক্তিস্বাতন্ত্র্যের প্রাধান্য লক্ষণীয়। তাঁর বর্ণনায় অলংকারের আধিক্য নেই; বরং স্বাভাবিক সৌন্দর্যেরই প্রাধান্য দৃশ্যমান। প্রকৃতপক্ষে, কালিদাস ছিলেন বহুমুখী প্রতিভার অধিকারী। তাঁর মধ্যে বিস্ময়কর কবিশক্তির নিত্যনতুন বিকাশ ঘটেছে। তাঁর জনপ্রিয়তার প্রধান কারণ তাঁর সহজ, পরিশীলিত এবং প্রসাদগুণসম্পন্ন শৈলী। সেই শৈলীতে সাবলীল, মনোরম, অকৃত্রিম, ধ্বনিমাধুর্য, আদর্শ এবং সঙ্গীতধর্মিতার এক অপূর্ব সমন্বয় বিদ্যমান।

তাঁর বর্ণনাগুলি প্রাণবন্ত। সেগুলিতে পুরাণাদির ন্যায় অনাবশ্যক বিস্তার নেই, শৈথিল্য নেই আবার পরবর্তী কবিদের মতো পাণ্ডিত্য প্রদর্শনের প্রবণতা নেই; দীর্ঘ সমাসের আধিক্য নেই, অলংকারের ভার নেই, কৃত্রিম কবিত্বও নেই। বরং তাঁর রচনায় প্রকৃত কবিত্বের

স্বাভাবিক প্রভাব স্পষ্টভাবে অনুভূত হয়। হৃদয়ের গভীরে নিহিত ভাবের মূর্ত প্রকাশ, মানবহৃদয়ের সূক্ষ্মতম ক্রিয়ার তাত্ত্বিক বিশ্লেষণ, মানবমনে প্রকৃতির প্রভাব এবং সুকোমল ভাবের কোমল ভাষায় অভিব্যক্তি; এই সমস্ত গুণ কালিদাসের রচনায় পরিলক্ষিত হয়। এই কারণেই মহাকবি কালিদাস সকল কবির উর্ধ্বে স্থান লাভ করেছেন। তিনি সংস্কৃতকবির মধ্যে অনন্য ও অদ্বিতীয়। এই সকল কারণেই সমালোচকেরা বলেছেন— “কালিদাস সকল সংস্কৃতকবির মধ্যে শ্রেষ্ঠ এবং তুলনাহীন।”

“পুৰা কবীনাং গণনাৎসজে
কনিষ্ঠিকাধিষ্ঠিতকালিদাসঃ।

অদ্যাপি তত্ত্বল্যকবেরভাবাদনামিকা সার্থবতী
বভূব।।”

মহাকবি কালিদাসের রচনায় প্রকাশিত গভীর পাণ্ডিত্য এবং ঋষিদের আশ্রমজীবনের সূক্ষ্ম বর্ণনা থেকে অনুমান করা যায় যে, তিনি কোনো না কোনো গুরুকুলে শিক্ষালাভ করেছিলেন। সেখানে তিনি অবশ্যই সংহিতা, ব্রাহ্মণগ্রন্থ, উপনিষদ, স্মৃতি, দর্শনশাস্ত্র, ধর্মশাস্ত্র, ব্যাকরণশাস্ত্র, পুরাণ, রাষ্ট্রনীতি, ইতিহাস, কাব্যশাস্ত্র, চিত্রকলা, সঙ্গীতকলা, আয়ুর্বেদ, জ্যোতিষশাস্ত্র, সমুদ্রশাস্ত্র, কামশাস্ত্র, মনোবিজ্ঞান, যুদ্ধবিজ্ঞান, উদ্ভিদবিজ্ঞান এবং পক্ষীবিজ্ঞান প্রভৃতি নানা শাস্ত্রের বিস্তৃত অধ্যয়ন করেছিলেন।

তবে এত বিশাল জ্ঞান ও পাণ্ডিত্যের অধিকারী হওয়া সত্ত্বেও তিনি ছিলেন নিরহঙ্কারী। তাঁর রচনায় কোথাও পাণ্ডিত্য প্রদর্শনের কৃত্রিম চেষ্টা দেখা যায় না; বরং জ্ঞান, বিনয় এবং স্বাভাবিক কাব্যপ্রতিভার এক অপূর্ব সমন্বয় লক্ষিত হয়। এই বিনয়ই তাঁর মহত্বকে আরও উজ্জ্বল করে তুলেছে এবং তাঁকে ভারতীয় সাহিত্যধারার এক অনন্য মহাকবির মর্যাদায় প্রতিষ্ঠিত করেছে।

“ক্লৃপ্যপ্রভবো বংশঃ ক্লচাল্লবিষয়া মতিঃ।
তিতীর্ষদুস্তরং মোহাদুপেনাস্মি সাগরম্।।”ⁱ

মহাকবি কালিদাস উপরোক্ত বিভিন্ন বিদ্যাও কলার গভীর অনুশীলনের পাশাপাশি বহু দেশ-বিদেশ ভ্রমণও করেছিলেন। তাঁর রচনায় কোথাও শাস্ত্রনির্ধারিত নিয়মের লঙ্ঘন পরিলক্ষিত হয় না। প্রকৃতপক্ষে, ভারতীয় সমস্ত বিদ্যাই বেদ থেকে উৎসারিত। কালিদাস-সাহিত্যেরও প্রধান উপজীব্য বেদসমূহ। এই কারণেই তাঁর সাহিত্যে বৈদিক সাহিত্যের এক অনুপম ও আশ্চর্য প্রভাব লক্ষ করা যায়। তাঁর বৈদিক জ্ঞানের পরিচায়ক বহু প্রসঙ্গ ও উল্লেখ তাঁর রচনায় বিদ্যমান। তবে

সেই সকল ইঙ্গিতপূর্ণ প্রসঙ্গের বিশদ আলোচনা গবেষণাপত্রের পরিধি অতিক্রম করবে বলে এখানে সংক্ষেপে কেবল দিকনির্দেশমাত্র উপস্থাপন করা হচ্ছে। বস্তুত, ঋষিগণ, শাস্ত্রকারগণ এবং কবিগণ নিজেদের প্রয়োজন ও উদ্দেশ্য অনুযায়ী জ্ঞানভাণ্ডাররূপ বেদসমূহের তত্ত্ব ও শিক্ষাকে তাঁদের নিজ নিজ গ্রন্থে প্রয়োগ করেছেন। এই কারণেই রাজশেখর একটি প্রাচীন উক্তি উদ্ধৃত করেছেন—

“নমোহস্ত তসৈ শ্রুতয়ে যাং দুহন্তি পদে পদে।

ঋষয়ঃ শাস্ত্রকারাশ্চ কবয়শ্চ যথামতি।।”ⁱⁱ

মহাকবি কালিদাস কাব্য ও নাটকের বহু স্থানে বৈদিক বচনের উল্লেখ করেছেন। এর উদ্দেশ্য ছিল পবিত্র, মঙ্গলময় প্রভৃতি ভাবনার জাগরণ ঘটানো। এর দ্বারা মহাকবি কালিদাসের বিস্তৃত বৈদিক অধ্যয়নের পরিচয় সুস্পষ্টভাবে প্রতিভাত হয়। প্রকৃতপক্ষে, মহাকবি কালিদাস বৈদিক ধর্মের অনুসারী ছিলেন। তিনি শ্রুতি-সম্মত বর্ণাশ্রম ব্যবস্থায় বিশ্বাসী ছিলেন। ঋগ্বেদের বর্ণব্যবস্থাসংক্রান্ত পুরুষসূক্তের ; ‘ব্রাহ্মণোইস্য মুখমাসীৎ...’ⁱⁱⁱ ; এই বৈদিক ধারণার প্রভাব কালিদাসের সমগ্র সাহিত্যেই পরিলক্ষিত হয়। তাঁর বিভিন্ন গ্রন্থে সমাজজীবনের বর্ণবিন্যাস ও আশ্রমব্যবস্থার প্রতি শ্রদ্ধা এবং তার আদর্শগত প্রতিফলন সুস্পষ্টভাবে প্রকাশিত হয়েছে। যেমন—

“নৃপস্য বর্ণাশ্রমপালনং যৎস এব ধর্মো মনুনা
প্রণীতঃ।

নির্বাসিতাহৈ প্যবমত ত্বয়া হং
তপস্বিসামান্যমবেক্ষণীয়াঃ।।”^{iv}

স্বামীর গৃহে গমনের সময় ঋষি কণ্ব কর্তৃক শকুন্তলাকে প্রদত্ত উপদেশ—“শুশ্রুষ্ব...”^v ; সম্পূর্ণরূপে ঋগ্বেদের এই “গৃহান্ গচ্ছ গৃহপত্নী যথাসো বশিনী ত্বং বিদথমা বদাসি”^{vi} মন্ত্রের দ্বারা প্রভাবিত বলে প্রতীয়মান হয়। অর্থাৎ, গৃহে গমন করো; গৃহপত্নীরূপে প্রতিষ্ঠিত হও; পরিবারের সকলকে স্নেহ ও প্রজ্ঞার দ্বারা বশে রেখে গৃহকার্যে এবং সভাসমিতিতে বিচক্ষণতার সঙ্গে মত প্রকাশ করো।

মহাকবি কালিদাস পুরুষার্থচতুষ্টয় (ধর্ম, অর্থ, কাম ও মোক্ষ) স্বীকার করেছিলেন। তাঁর দৃষ্টিতে মোক্ষই পরম পুরুষার্থ। তবে ত্রিবর্গের মধ্যে ধর্ম সর্বোৎকৃষ্ট; ধর্মের বিরোধিতা করে না এমন অর্থ ও কামও তাঁর নিকট প্রিয় ও গ্রাহ্য ছিল। তিনি সাধারণ মানুষকে ত্যাগ ও তপস্যার

আদর্শে উদ্বুদ্ধকরেছেন। মহাকবি কালিদাস বৈদিক শাস্ত্রসম্মত যজ্ঞপ্রথার একনিষ্ঠ সমর্থক ছিলেন। তাঁর রঘুবংশ মহাকাব্যে অশ্বমেধ প্রভৃতি যজ্ঞের বর্ণনা পাওয়া যায়।^{vii} আবার মালবিকাগ্নিমিত্র নাটকেও যজুর্বেদোক্ত অশ্বমেধযজ্ঞের উল্লেখ রয়েছে। রাজা দিলীপের পত্নী সুদক্ষিণাকে তিনি যজ্ঞের দক্ষিণার সঙ্গে তুলনা করে বলেছেন—“পত্নী সুদক্ষিণেত্যাসীদধ্বরস্যেব দক্ষিণা।”^{viii} অর্থাৎ, সুদক্ষিণা যেন যজ্ঞের দক্ষিণারই মূর্ত প্রতীক ছিলেন। এই কল্পনার উৎস বৈদিক ব্রাহ্মণ-সাহিত্যের উক্তি—“যজ্ঞো গন্ধর্বস্তস্য দক্ষিণা অঙ্গরসঃ” মহাকবি আরও ইঙ্গিত করেছেন যে, যজ্ঞমানের দৃষ্টি ধোঁয়ায় আচ্ছন্ন হয়ে গেলেও অগ্নিতে নিবেদিত আর্হতিই যজ্ঞের প্রকৃত অঙ্গ।^{ix} এর মাধ্যমে তিনি যজ্ঞবিধির মাহাত্ম্য সমর্থন করেছেন। তাঁর মতে, যজ্ঞের সফলতার জন্য কেবল বাহ্যিক আচারই যথেষ্ট নয়; শ্রদ্ধা ও অর্থসামর্থ্যের যথাযথ সমন্বয়ও অপরিহার্য। অতএব, অন্যভাবে মহাকবি কালিদাস এই সত্যই তুলে ধরেছেন যে, আন্তরিক বিশ্বাস, নিষ্ঠা এবং যথোচিত আয়োজনের সমন্বয়েই ধর্মীয় কর্ম পরিপূর্ণতা লাভ করে। তাই মহাকবি কালিদাস তাঁর শকুন্তলা নাটকে বলেছেন,
“দিষ্ট্যা শকুন্তলা সাধ্বী সদপত্যমিদং ভবান্।

শ্রদ্ধা বিভ্রং বিধিশেচতি ত্রিতয়ং তৎ সমাগতম্।।”^x

তিনি বৈদিক কর্মকাণ্ডের একনিষ্ঠ সমর্থক ছিলেন। তাঁর মতে, বৌদ্ধধর্মের বিরোধিতা বা তার প্রসারের প্রেক্ষাপটেও কখনও বৈদিক কর্মকাণ্ড পরিত্যাগ করা উচিত নয়। অর্থাৎ, বৈদিক ধর্মপ্রথা ও শাস্ত্রবিধি অনুসৃত যজ্ঞাদি আচারের প্রতি আস্থা ও অনুশীলন অটুট রাখা প্রয়োজন—এই মনোভাবই তাঁর রচনায় প্রতিফলিত হয়েছে—

“সহজং কিল যদ্‌বিনিদ্ভিতং ন খলু তৎকর্ম বিবর্জনিয়ম্।

পশুমারণকর্মদারুণোইনুমস্পামুদুরেব শ্রোত্রিয়ঃ।।”^{xi}

মহাকবি কালিদাসের রচনায় বৈদিক যজ্ঞসংস্কৃতির প্রতি গভীর শ্রদ্ধা ও সমর্থনের পরিচয় পাওয়া যায়। তিনি বলেছেন—“তদ্‌ ভবতু বিডৌজাঃ প্রাজ্যবৃষ্টিঃ প্রজাসু, ত্বমপি বিততযজ্ঞো বজ্রিণং প্রীণয়স্ব।”

অর্থাৎ, প্রজাদের কল্যাণে প্রচুর বৃষ্টিপাত হোক; আর তুমিও বিস্তৃত যজ্ঞের মাধ্যমে বজ্রধারী ইন্দ্রকে সন্তুষ্ট করো।। এছাড়াও, “সায়ন্ত নৈ স বনকর্মণি অগ্নিশরণপ্রবিস্তস্য” প্রভৃতি কালিদাসীয় বর্ণনায় শতপথ ব্রাহ্মণ-এ উল্লিখিত “যজ্ঞো বৈ শ্রেষ্ঠতমং কর্ম”^{xii} অর্থাৎ, “যজ্ঞই শ্রেষ্ঠতম কর্ম”; এই বৈদিক ধারণার সুস্পষ্ট প্রভাব

লক্ষ করা যায়। এর দ্বারা প্রতীয়মান হয় যে, কালিদাস বৈদিক যাজ্ঞিক কর্মকাণ্ডের মাহাত্ম্য সম্পর্কে গভীরভাবে অবগত ছিলেন এবং তাঁর সাহিত্যেও সেই ভাবধারার প্রতিফলন তিনি ঘটিয়েছেন। আবার, রঘুবংশ মহাকাব্যে শ্রুতিসম্মত কল্পনার উপর ভিত্তি করে এক মনোরম উপমার প্রয়োগ দেখা যায়। সেখানে বর্ণিত হয়েছে যে, নন্দিনীর পশ্চাতে রাজা দিলীপের পত্নী সুদক্ষিণা এমনভাবে চলছিলেন, যেমন স্মৃতি শ্রুতির অনুসরণ করে। সংস্কৃত মূলটি হল— “নন্দিন্যাঃ মার্গো দিলীপস্য রাডঃ পত্নী সুদক্ষিণা তথৈব চলতিস্ম যথা শ্রুতিং স্মৃতিরনুসরতি।” এর ভাবার্থ—যেমন স্মৃতিশাস্ত্র বেদের (শ্রুতির) নির্দেশ অনুসরণ করে, তেমনি সুদক্ষিণা নন্দিনীর পদাঙ্ক অনুসরণ করছিলেন। এই উপমার মাধ্যমে কালিদাস একদিকে যেমন বৈদিক সাহিত্যের প্রতি তাঁর গভীর শ্রদ্ধা প্রকাশ করেছেন, তেমনি ভারতীয় ধর্মীয় ও সাংস্কৃতিক পরম্পরায় শ্রুতি ও স্মৃতির পারস্পরিক সম্পর্কের আদর্শ রূপটিও কাব্যিক সৌন্দর্যের সঙ্গে উপস্থাপন করেছেন।

“তস্যাঃ খুরন্যাসপবিত্রপাংসুমপাংসুলানাং ঘুরি কীর্তনীয়া।
মার্গং মনুষ্যেশ্বরধর্মপত্নী শ্রুতেরিবার্থং স্মৃতিরনুগচ্ছৎ।।”
xiii

মহর্ষি মনু যেমন সকল রাজাদের মধ্যে প্রথম বলে গণ্য, তেমনি বেদমন্ত্রসমূহের মধ্যে ‘ওঁ’ (প্রণব) সর্বপ্রথম ও শ্রেষ্ঠ। এই ভাবটিকেই কালিদাস প্রকাশ করেছেন— “আসীন্মহীক্ষিতামাদ্যঃ প্রণবশ্ছন্দসামিব”^{xiv} অর্থাৎ, যেমন ছন্দসমূহের মধ্যে প্রণব (ওঁ) সর্বপ্রথমে, তেমনি রাজাদের মধ্যে মনু ছিলেন প্রথম। মহাকবি কালিদাস বৈদিক ছন্দের জ্ঞানও ছিল অপর। তিনি বৈদিক ছন্দ অনুসারে কাব্যরচনা করতে সক্ষম ছিলেন। এর দ্বারা প্রতীয়মান হয় যে, তিনি বৈদিক ছন্দশাস্ত্রের একজন সুপণ্ডিত ছিলেন। তাঁর রচনায় ঋগ্বেদের উদাত্ত, অনুদাত্ত ও স্বরিত প্রভৃতি বৈদিক স্বরের উল্লেখও পাওয়া যায়। উপনিষদসমূহ মূলত বেদনির্ভর। উপনিষদ-প্রভাবিত শ্রীমদ্ভগবদ্গীতার প্রভাবও কুমারসম্ভব কাব্যে লক্ষ করা যায়। শ্রীমদ্ভগবদ্গীতার—“দেবান্‌ভাবয়তানেন তে দেবা ভাবয়ন্ত বঃ”^{xv} অর্থাৎ, যজ্ঞের মাধ্যমে দেবতাদের সন্তুষ্ট করো; দেবতারাও তোমাদের কল্যাণ সাধন করবেন; এই শ্লোকের ভাবকে পুনরুচ্চারণ করে কালিদাস যজ্ঞবিধির সমর্থন করেছেন। তিনি বলেছেন—

“তব ভবতু বিডৌজাঃ প্রাজ্যবৃষ্টিঃ প্রজাসু...
শ্লাঘনীয়ে।।”^{xvi}

অর্থাৎ, প্রজাদের কল্যাণের জন্য প্রচুর বৃষ্টিপাত হোক এবং যজ্ঞের মাধ্যমে দেবতার সন্তুষ্টি হোন।

বেদে পুনর্জন্মতত্ত্ব স্পষ্টভাবে প্রতিপাদিত হয়েছে। কালিদাসও তাঁর বিভিন্ন রচনায় এই পুনর্জন্মের ধারণাকে সমর্থন করেছেন। নিরুজ্জ্বল বলা হয়েছে যে, বিদ্যা নিজেই ব্রাহ্মণের নিকট আগমন করে। এই ভাবই কালিদাসের উক্তি-তে প্রতিফলিত হয়েছে-- “সুশিষ্যপরিদত্তা বিদ্যেবাম্বোচনীয়া সবৃত্তা”^{xvii} অর্থাৎ, যেমন যোগ্য শিষ্যের হাতে অর্পিত বিদ্যা অনুশোচনার কারণ হয় না, তেমনি তুমি (শকুন্তলা) আজ আর চিন্তার পাত্র নও। যজুর্বৈদ্যসম্মত নামকরণ-সংস্কার রঘুবংশ-এ রঘুর নামকরণ সময়ের বর্ণনায় দেখা যায়। একইভাবে জাতকর্ম প্রভৃতি অন্যান্য সংস্কারেরও বিশদ বিবরণ তাঁর রচনায় পাওয়া যায়।

কুমারসম্ভব-এ শিব-পার্বতীর এবং রঘুবংশ-এ অজ-ইন্দুমতীর বিবাহবর্ণনা মূলত গৃহসূত্রনির্ভর। গৃহসূত্রের বিধান অনুযায়ী বিবাহোত্তর তিন রাত্রি পর্যন্ত নবদম্পতির ব্রহ্মচর্য পালন ও ভূমিশয়ন করা উচিত। কুমারসম্ভব-এ ভগবান শিব এই বিধান পালন করেছেন বলে বর্ণিত হয়েছে। আবার, আশ্বলায়ন গৃহসূত্র অনুসারেই বিবাহের প্রসঙ্গে শিবের মন্ত্রপাঠ, মধুমিশ্রিত দধি গ্রহণ এবং নববস্ত্র পরিধানের বর্ণনা কালিদাস প্রদান করেছেন। বৈদিক দর্শন অনুযায়ী, সৃষ্টির আদিরূপ ছিল জল। ঋগ্বেদের নাসদীয় সূক্তে এই ধারণা প্রকাশিত হয়েছে। তৈত্তিরীয় ব্রাহ্মণ-এ বলা হয়েছে-- “আপো বা ইদমগ্রে সলিলমাসীৎ”^{xviii} অর্থাৎ, আদিতে এই বিশ্ব ছিল জলময়। শতপথ ব্রাহ্মণ-এও একই মত প্রকাশিত হয়েছে। কালিদাসের রচনাতেও এই বৈদিক ধারণার সুস্পষ্ট উল্লেখ দেখা যায়।

ঋগ্বেদের অগ্নিসূক্তে অগ্নিকে যজ্ঞের পুরোহিত, ঋত্বিক, দেবতা এবং হোতা বলা হয়েছে। কালিদাস শিবের অগ্নিরূপ মূর্তির প্রসঙ্গে বলেছেন-- “বহতি বিধিহুতং যা হবিঃ”^{xix} অর্থাৎ, যিনি বিধিসম্মতভাবে অর্পিত আহুতি দেবতাদের কাছে পৌঁছে দেন। ঋগ্বেদের বিখ্যাত উক্তি-- “একং সদ বিপ্রা বহুধা বদন্তি”^{xx} অর্থাৎ, সত্য এক, জ্ঞানীগণ তাকে নানাভাবে বর্ণনা করেন-- এই ভাবধারার প্রভাব কালিদাসের রচনাতেও বিদ্যমান। শিবের বহুরূপতার বর্ণনায় এই বৈদিক একেশ্বরবাদী দৃষ্টিভঙ্গির প্রতিফলন লক্ষ করা যায়। প্রকৃতপক্ষে, কুমারসম্ভব-এ তিনি ব্রহ্মা ও শিবের এবং রঘুবংশ-এ বিষ্ণুর স্তব করেছেন। এর দ্বারা বোঝা যায় যে, তিনি মূলত

একেশ্বরবাদের সমর্থক ছিলেন, যদিও সেই এক পরমসত্তাকে বিভিন্ন রূপে উপলব্ধি করেছেন।

কালিদাস বিক্রমোর্বশীয় নাটকের গঠনপ্রেরণা ঋগ্বেদ এবং শতপথ ব্রাহ্মণ থেকে লাভ করেছিলেন। উপনিষদ এবং মনুস্মৃতি-র প্রভাবও কুমারসম্ভব-এ সুস্পষ্ট। উপনিষদে শ্রেয় (কল্যাণকর পথ) এবং প্রেয় (ইন্দ্রিয়সুখকর পথ)-এর আলোচনা পাওয়া যায়। কালিদাসও শ্রেয় ও প্রেয় উভয়েরই গুরুত্ব স্বীকার করেছেন। তিনি মেঘদূতকাব্যে এই জীবনদর্শনের পরিচয় দিয়েছেন।

“বিদ্যুদ্বামক্ষুরিতচকিতৈস্তত্র পৌরাজ্ঞানানাং লোলাপাঙ্গৈর্ষাদিন রমসে লোচনৈর্বিধিতোহসি।”^{xxi}

সেখানেই কালিদাস দেখিয়েছেন যে, শ্রেয় (পরম কল্যাণ) কেবল ব্যক্তিগত মুক্তির পথ নয়; গার্হস্থ্যজীবন পালনকারী মানুষের জন্যও তার বিশেষ গুরুত্ব রয়েছে। তিনি বলেন-- “শ্রেয়সী ভাবতী মহত্তা জীবনায় প্রজায়ৈ গৃহমেধিনাম্; যোগেনান্তে তনুতাজাম্” অর্থাৎ, গৃহস্থ মানুষের পক্ষে প্রজাপালন ও জীবনযাপনের জন্য শ্রেয়ের বিশেষ মাহাত্ম্য রয়েছে; এবং জীবনের অন্তিম পর্বে যোগের মাধ্যমে দেহত্যাগ করে তারা পরম কল্যাণ লাভ করে।

কালিদাসের সাহিত্যদর্শনে শ্রেয় ও প্রেয়ের সমন্বয়ও প্রত্যক্ষ করা যায়। তিনি বলেছেন--

“বয়ং তদ্বাশ্বেষান্মধুকর! হতাত্ত্বং খলু কৃতী।”^{xxii}

অর্থাৎ, হে ভ্রমর! সত্যতত্ত্বের অনুসন্ধান না করে কেবল বাহ্যিক আকর্ষণে মুগ্ধ হওয়া জ্ঞানীর কাজ নয়। এই দৃষ্টিভঙ্গির এক উৎকৃষ্ট উদাহরণ দুষ্যন্ত ও শকুন্তলার সম্পর্ক। দুষ্যন্ত শকুন্তলার রূপ-সৌন্দর্যে আকৃষ্ট হয়ে তাকে উপভোগ করতে চেয়েছিলেন। অর্থাৎ, প্রেয় বা ইন্দ্রিয়সুখের প্রতি তাঁর প্রবল আকর্ষণ ছিল। কিন্তু তাঁর কাছে শ্রেয়, অর্থাৎ নৈতিক ও ধর্মসম্মত কল্যাণের মূল্যও ছিল অপারিসীম। এই কারণেই, যথাযথ অনুসন্ধান ও সত্যের প্রতিষ্ঠা না হওয়া পর্যন্ত তিনি শকুন্তলাকে গ্রহণ করেননি। প্রেয়ের তুলনায় শ্রেয়ের গুরুত্ব তাঁর দৃষ্টিতে অধিক ছিল। ফলে, কালিদাসের সাহিত্যচিন্তায় আমরা এমন এক জীবনদর্শনের সন্ধান পাই, যেখানে শ্রেয় ও প্রেয়-উভয়কেই স্বীকৃতি দেওয়া হয়েছে; তবে শ্রেয়কেই অধিক মর্যাদা প্রদান করা হয়েছে।

অতএব বলা যায়, কালিদাস শ্রেয়মূলক প্রেয়ের আদর্শকে গ্রহণ করেছিলেন। এমন ভোগ ও আনন্দকে তিনি সমর্থন করেছেন, যা ধর্ম ও নৈতিকতার সীমার মধ্যে

অবস্থান করে এবং পরমকল্যাণের পথে বাধা সৃষ্টি করে না। এই দৃষ্টিভঙ্গিই তাঁর জীবনবোধ ও সাহিত্যদর্শনের অন্যতম বৈশিষ্ট্য।

“ভ্রমর ইব বিভাতে কুন্দমন্তঃ তুষারং ন চ সহ পরিভোজ্যং নৈব শক্লোমি হাতুম্”^{xxiii}

এই প্রসঙ্গে উল্লিখিত ভাবটি বিশেষভাবে বিবেচনার যোগ্য। উপর্যুক্ত সংক্ষিপ্ত আলোচনার মাধ্যমে জানা যায় যে, মহাকবি কালিদাসের শ্রুতি ও বৈদিক সাহিত্যে বিষয়ে অসাধারণ ও গভীর জ্ঞান ছিল। তিনি বৈদিক বর্ণব্যবস্থা এবং আশ্রমব্যবস্থার সমর্থক ও পৃষ্ঠপোষক ছিলেন। তাঁর কাব্যের আদর্শ চরিত্রগুলি শ্রুতিনির্দেশিত নীতি ও বিধান মেনে চলত। প্রকৃতপক্ষে, মহাকবি কালিদাস তাঁর কাব্যসৃষ্টির মাধ্যমে নিশ্চিতভাবেই বেদের

উদ্‌ঘাটক, সংরক্ষক, ব্যাখ্যাতা এবং প্রচারক হিসেবে ভূমিকা পালন করেছিলেন। তাঁর কাব্যসমূহের প্রধান উপজীব্য যে বেদ, সে বিষয়ে কোনো সন্দেহের অবকাশ নেই। এই আলোচনা থেকে স্পষ্টভাবে প্রতীয়মান হয় যে, কালিদাসের রচনাবলীতে বৈদিক সাহিত্যের এক অনুপম ও বিস্ময়কর প্রভাব বিদ্যমান ছিল। বৈদিক দর্শন, ধর্মীয় আচরণ, সামাজিক আদর্শ, সংস্কার-পদ্ধতি এবং আধ্যাত্মিক চেতনা তাঁর রচনারবিভিন্ন স্তরে গভীরভাবে প্রোথিত হয়েছে। ফলে, কালিদাসের সাহিত্য কেবল নান্দনিক রসাস্বাদের উৎস নয়; বরং তা বৈদিক ঐতিহ্য ও ভারতীয় সাংস্কৃতিক মূল্যবোধের এক গুরুত্বপূর্ণ বাহক বিবেচিত হতে পারে।

- i. রঘুবংশ, ১/২
- ii. কাব্যমীমাংসা সপ্তম অধ্যায়
- iii. ঋগ্বেদ পুরুষসূক্ত, ১০/৯০/১২
- iv. রঘুবংশ ১৪/৬৭
- v. অভিজ্ঞানশকুন্তলা, ৪/১৮
- vi. ঋগ্বেদ, ১০/৮৫/২৬
- vii. রঘুবংশ, ৪/৮৬/১
- viii. রঘুবংশ, ১/৩১
- ix. অভিজ্ঞানশকুন্তলা চতুর্থ অঙ্ক
- x. অভিজ্ঞানশকুন্তলা, ৭/২৯
- xi. অভিজ্ঞানশকুন্তলা, ৬/১
- xii. শতপথব্রাহ্মণ, ১.৭.৩.৫

- xiii. রঘুবংশ, ২/২
- xiv. রঘুবংশ, ১/১১
- xv. শ্রীমদ্ভগবদ্গীতা, ৩/১১
- xvi. অভিজ্ঞানশকুন্তলা, ৭/৩৪
- xvii. অভিজ্ঞানশকুন্তলা চতুর্থ অঙ্ক
- xviii. শতপথব্রাহ্মণ, ১১/১/৬/১
- xix. অভিজ্ঞানশকুন্তলা, ৭/১
- xx. ঋগ্বেদ, ১/১৬৪/৪৬
- xxi. মেঘদূতম, পূর্বার্ধে,
- xxii. অভিজ্ঞানশকুন্তলা, ৭/২৪
- xxiii. অভিজ্ঞানশকুন্তলা, ৫/১৯

গ্রন্থবিবরণী

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২. আচার্য সীতানাথ, এবং দাস ডি. কে. (১৯৯৮) উত্তররামচরিত (প্রথম সংস্করণ) সংস্কৃত পুস্তক ভাণ্ডার।
৩. ভট্টাচার্য্য, বি. পি., এবং অধিকারী, টি. (২০০৭ - ২০০৮) বৈদিক সংকলন (খণ্ড ১-২), পুনর্মুদ্রণ, সংস্কৃত বুক ডিপো।
৪. স্বামী গন্তীরানন্দ, (২০১৩) বৃহদারণ্যকোপনিষদ, (১৯ তম সংস্করণ) উদ্বোধন কার্যালয়।
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৮. দাস, কে. এস. (১৯৯৬) সংস্কৃত সাহিত্য পরিক্রমা (দ্বিতীয় সংস্করণ), রত্নাবলী।
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১০. বসু, ড. ওয়াই., (২০১৩) বেদের পরিচয়, (নবম সংস্করণ), ফার্মা কে. এল. এম. প্রাইভেট লিমিটেড।
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Emerging Applications of Artificial Intelligence in Medical Diagnosis

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Abstract

Artificial Intelligence (AI) and Machine Learning (ML) are rapidly transforming medical diagnosis by enabling the efficient analysis of complex healthcare data, including medical images, electronic health records, and genomic information. AI-based diagnostic tools have demonstrated high accuracy in detecting diseases across various specialties such as oncology, cardiology, neurology, dermatology, and ophthalmology. These technologies support early disease detection, risk prediction, and personalized treatment planning, thereby improving clinical decision-making and patient outcomes. Despite their significant potential, challenges related to data privacy, algorithmic bias, transparency, and regulatory approval remain barriers to widespread implementation. Continued advancements in AI, wearable health technologies, and precision medicine are expected to further enhance diagnostic capabilities and healthcare delivery in the future medicine

Keywords: Artificial Intelligence, Machine Learning, Medical Diagnosis, Deep Learning, Precision Medicine, Health Technologies.

Introduction

Artificial Intelligence (AI) has emerged as one of the most influential technological advancements in modern healthcare, transforming the way diseases are diagnosed, monitored, and managed [1]. The increasing burden of chronic diseases, aging populations, rising healthcare expenditures, and global health emergencies have accelerated the adoption of AI-driven solutions in clinical practice [2]. AI comprises a diverse set of computational technologies,

including machine learning (ML), natural language processing (NLP), computer vision, and advanced analytics, which enable healthcare systems to process and interpret vast amounts of complex medical data efficiently. The growing demand for accurate, timely, and personalized healthcare has further stimulated interest in integrating AI into diagnostic and therapeutic workflows [3].

Recent advances in AI have enabled the rapid analysis of medical images, genomic data, physiological signals, and electronic health records (EHRs), providing valuable support for clinical decision-making. AI-powered algorithms can identify subtle patterns and relationships within large datasets that may be difficult for human experts to detect, thereby enhancing diagnostic accuracy and reducing clinical workload [1]. These technologies have demonstrated significant potential across a wide range of medical specialties by facilitating early disease detection, risk prediction, and personalized treatment planning [4]. In particular, applications in radiology, pathology, genomics, cardiology, and ophthalmology have shown remarkable improvements in the interpretation of complex medical information, contributing to more efficient, accurate, and cost-effective healthcare delivery. As AI technologies continue to evolve, they are expected to play an increasingly important role in advancing precision medicine and improving patient outcomes worldwide.

Historical Development and Evolution of Artificial Intelligence in Healthcare

The evolution of artificial intelligence (AI) in

healthcare has been marked by significant technological advancements over the past five decades. The earliest applications of AI in medicine emerged during the 1970s and 1980s with the development of rule-based expert systems designed to mimic human clinical reasoning. One of the most notable examples was MYCIN, an expert system developed to assist physicians in diagnosing bacterial infections and recommending appropriate antimicrobial therapies. These systems relied on predefined knowledge bases and logical inference rules to support clinical decision-making [5].

The limitations of rule-based systems, including their dependence on manually encoded knowledge and restricted adaptability, led to the emergence of machine learning (ML) approaches. Unlike traditional expert systems, ML algorithms can learn complex relationships directly from data, enabling continuous improvement in predictive performance as larger datasets become available [6]. The rapid growth of digital healthcare data, combined with advances in computational power and cloud-based infrastructure, has accelerated the adoption of AI technologies across the healthcare sector.

More recently, the development of deep learning algorithms, particularly artificial neural networks and convolution neural networks (CNNs), has revolutionized medical diagnostics. These models are capable of extracting intricate features from medical images, genomic datasets, and electronic health records (EHRs), often achieving diagnostic performance comparable to that of experienced healthcare professionals [7]. The integration of big data analytics, high-performance computing, and AI has further expanded the scope of intelligent healthcare systems.

Today, AI plays a pivotal role in numerous aspects of healthcare, including disease screening and early detection, risk prediction, clinical decision support, medical image interpretation, precision medicine, and population health

management. As AI technologies continue to mature, their applications are expected to become increasingly integrated into routine clinical practice, contributing to improved healthcare quality, efficiency, and patient outcomes [8].

Role of Artificial Intelligence and Machine Learning in Medical Diagnosis

Artificial Intelligence (AI) and Machine Learning (ML) are transforming medical diagnostics by addressing many limitations associated with conventional diagnostic approaches, including diagnostic variability, time constraints, and human error [9]. By enabling the rapid analysis of large and complex healthcare datasets, AI-driven systems support early disease detection, risk prediction, and evidence-based clinical decision-making [4].

Advanced AI algorithms can efficiently process medical images, genomic data, laboratory findings, and electronic health records, facilitating the identification of subtle disease patterns that may be overlooked during routine clinical evaluation [10]. Consequently, AI has significantly improved diagnostic accuracy and efficiency across multiple specialties, particularly radiology, pathology, cardiology, and genomics.

Beyond diagnosis, AI contributes to drug discovery, treatment optimization, and precision medicine by enabling personalized therapeutic strategies based on individual patient characteristics [11]. The integration of AI into healthcare workflows has further enhanced operational efficiency, reduced diagnostic turnaround times, and improved patient outcomes [12]. Owing to these advancements, AI and ML have become essential tools in modern healthcare and are expected to play an increasingly important role in the future of medical diagnosis.

Machine Learning

Machine Learning (ML) is a subset of artificial intelligence that enables computer systems to learn patterns from historical data

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and generate predictive models without explicit programming. Commonly used ML algorithms in healthcare include logistic regression, decision trees, random forests, support vector machines, and gradient boosting models. These techniques have been widely applied in disease prediction, risk stratification, and clinical decision support systems. In medical diagnostics, ML models have demonstrated significant utility in diabetes prediction, cardiovascular risk assessment, cancer prognosis, and patient stratification, thereby facilitating early intervention and personalized healthcare strategies [13, 14].

Deep Learning

Deep Learning (DL), a specialized branch of machine learning, employs multilayer artificial neural networks to automatically learn complex features from large and diverse datasets. Unlike conventional ML approaches, deep learning algorithms can perform automated feature extraction, making them particularly effective for image-based diagnostics. Recent advances in convolutional neural networks (CNNs) have significantly improved the interpretation of radiological images, histopathological slides, and dermatological lesions. Consequently, deep learning models have achieved diagnostic accuracies comparable to those of experienced clinicians in several medical specialties, particularly in oncology, radiology, and dermatology [15, 16].

Natural Language Processing

Natural Language Processing (NLP) enables computers to interpret, analyze, and generate human language. In healthcare, NLP has become an important tool for extracting clinically relevant information from unstructured medical data, including physician notes, discharge summaries, pathology reports, and electronic health records (EHRs). NLP applications facilitate automated clinical documentation, disease surveillance, medical literature mining, and

decision support, thereby improving information accessibility and reducing administrative burden within healthcare systems [17].

Computer Vision

Computer Vision is a branch of AI that focuses on the automated analysis and interpretation of visual information. In medical diagnostics, computer vision technologies enable the accurate assessment of medical images obtained from modalities such as X-ray, computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, and digital pathology. By detecting subtle anatomical and pathological features, computer vision systems enhance diagnostic accuracy, support disease classification, and assist clinicians in identifying abnormalities that may be difficult to detect through manual interpretation alone. These capabilities have made computer vision one of the most influential AI technologies in modern diagnostic medicine [18, 19]. Figure. - 1

Clinical Applications of Artificial Intelligence in Medical Diagnosis

AI in Radiological Diagnostics

Radiology represents one of the most successful applications of artificial intelligence in clinical medicine. Deep learning models, particularly convolutional neural networks (CNNs), have demonstrated remarkable performance in the interpretation of medical images, often achieving diagnostic accuracy comparable to experienced radiologists. AI-assisted systems are widely used for the detection of lung nodules, breast cancer screening, fracture identification, and brain tumor classification. These technologies enhance image analysis, reduce diagnostic workload, and facilitate early disease detection [20, 21].

AI in Pathology

The integration of artificial intelligence with digital pathology has transformed tissue-based diagnosis by enabling automated image analysis and quantitative assessment of

histological specimens. AI algorithms can accurately identify tumors, perform histological grading, quantify cellular components, and detect diagnostic biomarkers. By minimizing inter-observer variability and improving reproducibility, AI-assisted pathology has enhanced diagnostic precision and efficiency in routine clinical practice [22, 23].

AI in Cardiovascular Medicine

Cardiovascular diseases remain a leading cause of global morbidity and mortality, creating a substantial need for accurate and timely diagnostic tools. AI-based approaches have shown considerable promise in electrocardiogram (ECG) interpretation, arrhythmia detection, echocardiographic analysis, and heart failure prediction. These systems facilitate early risk assessment and clinical decision-making, thereby improving patient management and outcomes [24, 25].

AI in Oncology

Artificial intelligence has become an integral component of modern oncology by supporting cancer detection, classification, prognosis, and treatment planning. AI algorithms can analyze radiological images, histopathological slides, genomic datasets, and biomarker profiles to identify malignant changes and predict therapeutic responses. Such capabilities contribute significantly to precision oncology, enabling personalized treatment strategies tailored to individual patient characteristics [26, 27].

AI in Ophthalmology

Ophthalmology has emerged as a prominent field for AI implementation due to the availability of high-quality retinal imaging data. Deep learning systems have demonstrated high sensitivity and specificity in detecting diabetic retinopathy, glaucoma, and age-related macular degeneration. These automated diagnostic tools are particularly

beneficial in resource-limited settings, where access to specialist care may be restricted, thereby supporting large-scale screening programs and early intervention [28, 29].

AI in Infectious Disease Diagnosis

The role of artificial intelligence in infectious disease diagnosis gained considerable attention during the COVID-19 pandemic. AI-driven models were utilized for chest computed tomography (CT) interpretation, disease surveillance, outbreak forecasting, and clinical risk stratification. Beyond COVID-19, AI continues to support the diagnosis and monitoring of infectious diseases through predictive analytics and real-time epidemiological surveillance, enhancing public health preparedness and response capabilities [30, 31].

Conclusion

Artificial Intelligence (AI) and Machine Learning (ML) are reshaping medical diagnostics by improving the accuracy, speed, and efficiency of disease detection and clinical decision-making. Their applications across radiology, pathology, cardiology, oncology, ophthalmology, and infectious disease diagnosis have demonstrated significant potential to enhance patient care and support precision medicine.

Despite these advancements, challenges related to data privacy, algorithmic bias, interpretability, and regulatory oversight continue to limit widespread clinical adoption. Addressing these issues through the development of transparent, reliable, and ethically governed AI systems will be essential for their successful integration into healthcare.

In conclusion, AI is expected to serve as a valuable adjunct to clinical expertise rather than a replacement for healthcare professionals. Continued technological innovation and interdisciplinary collaboration will further strengthen the role of AI in delivering efficient, accurate, and patient-centered healthcare in the future.

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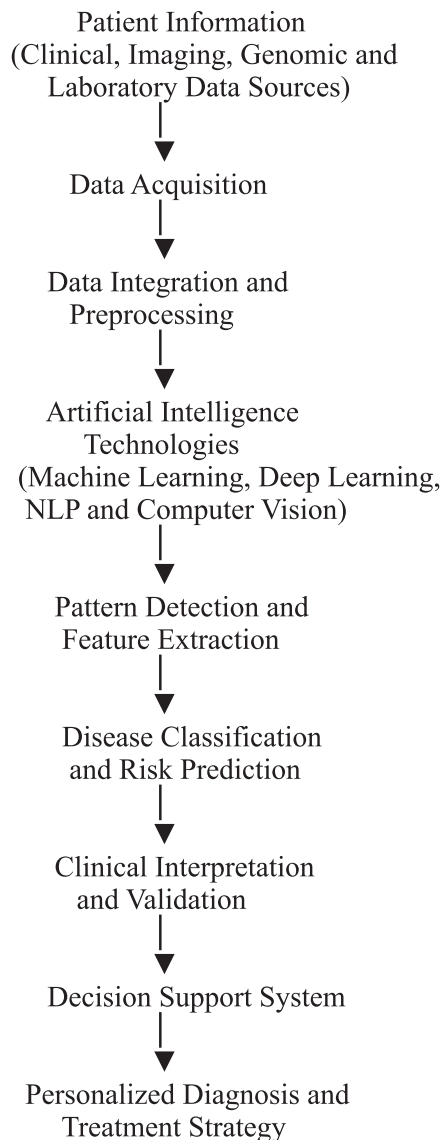
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Figure 1. Framework of Artificial Intelligence in Medical Diagnostic Decision-Making



Sari Songs as a Mode of Syncretism of Twentieth Century Bengali Culture

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Abstract : *Sari Gaan* (Sari songs), a traditional genre of folk music deeply rooted in the riverine landscape of Bengal, serves as a profound cultural manifestation of syncretism. Historically originating as rhythmic work songs (*shromsongeet*) sung collectively by boatmen during boat races (*nowkabaich*) and later adapted by construction workers during roof-beating (*chhadpetano*), these songs transcend mere occupational utility to bridge socio-religious divides. This paper explores how *Sari Gaan* functions as a vital site for Bengali syncretic culture (*samanwaysanskriti*). Finally, this article argues that *Sari Gaan* subverts orthodox religious dogmas and rigid caste hierarchies, offering a powerful historical template for the fluid, pluralistic, and unified cultural fabric of Bengal.

Keywords : *Sari Gaan*, Syncretism, Folk Culture, Work Songs, Communal Harmony.

Introduction -Boat was a space shared by both the Hindu and the Muslim communities. It virtually became the home for the boatmen belonging to both communities when they departed for a long journey. They used to sing various songs in their free time, or when they tried to forget the agony of hard work as well as remembered their loved ones who were away from them. Primarily two kinds of songs were sung by them on boats. One genre of songs was *bhatiyali* and the other one was *sari*. It is certainly difficult to identify the lyricists or composers of these songs due to the lack of sources. Interestingly, the lyrics of

both genres of songs were created by boatmen themselves, in which were combined their emotions, natural surroundings, time and circumstances. Later some of these songs found their way into literary sources and composed by others artists as well. Such songs were usually performed on a boat following a certain order. After they started steering the boat, helmsmen would begin a song and other boatmen would follow it. The main singer of such songs is called *bayati*. Apparently, the songs were sung for their leisure and to refresh their mind in order to reduce the burden of their hard labour.¹

Through this practice, boatmen entered the world of Bengal's mysticism. The icons and motifs represented in these songs and their language were rooted in the multi-dimensional world of Bengal mysticism. To put the point in a historical context, references to *saari* songs can be found in *Manasamangal Kavya*, which is oldest of the Bengali *Mangal Kavyas*—a groups of texts composed between the thirteenth and eighteenth centuries with narratives of indigenous deities of rural Bengal. There are different texts available of *Manasamangal* composed by different poets. While depicting a scene of the spring, the fifteenth-century poet Bijay Gupta wrote in *Manasamangal*:

Kuhu kuhu kariya kokil gay saari

*Charidike beriya Madan koredhari.*²

(Cuckoos are singing *saari* songs
Lord Madana is moving in circles and playing.)

In the verses quoted above, 'Madan' is the Hindu *Puranic* deity Lord Madana, who is the god of erotic love, desire and beauty. Bipradas Pipilai, another Bengali poet from the fifteenth century, depicted a situation in *Monosamongol* in which Chand Sadagar, an eminent trader and the protagonist of the narrative, left home on a trading voyage:

*Pujilo betai Chandi Chand
dandadhor*

*Haroshite saari gaynayer Nafar.*³

(Chand the ruler worships Goddess Chandi

Shyam Chand Gupta (1774–1854) published a collection of *saari* songs titled *Saari Gaan Sangraho* and later, Ramprasad Gupta also published a similar collection with the title *SaariGaan*. During the reign of the Mughal emperor Jahangir (1605–1627), the genre of *saari* songs was introduced through boat race.⁴ As mentioned earlier, the icons and motifs represented in this type of songs and their language were rooted in the world of Bengal mysticism, but the form of these songs was the innovation of boatmen. As composers and performers of *saari* songs, boatmen also acted as agents in the making of the heterodox religious tradition in Bengal.⁵

The themes of these songs deserve close academic attention. While the themes include the romantic love of Radha and Krishna, ShriChaitanya, folk romance, prank and anatomy, etc., according to some collectors of *saari* songs, the predominant theme in these songs is various exploits (*leela*) of Lord Krishna.⁶ Timothy Rice has argued, “Phenomenologically, musical experience in the present is partly conditioned by inveterate previous experience.”⁷ Taking a cue from this point, it can be argued that the historical past can also be traced through these songs. An extract from one *saari* song is cited below as an instance:

One good example of love is the love
of Radha and Krishna
They fell in love eons back, and still
today they are crushed.⁸

In this song, the experience of the past is seen

as a continuity perpetuated in the lived present. Probably the earliest instances of *saari* song were collected in 1813-14, which were quoted in Jaynarayan Ghoshal's *Karunanidhan Bilash*. The text depicts a love scene (*leela*) with the milkmaids on a boat:

The young Krishna is the head pilot

The whole world is at play in the
waters

His magic turns water creatures into
boats

Krishna is the majhi and the
milkmaids the rowers

As they row, their bangles and
anklets rattle to the rhythm

On the highest note, the women of
pleasure sing.⁹

In another example of the love scene
with Radha, collected in the twentieth
century, the chief playmate was Lord
Krishna with milkmaids as his
accomplices:

O Kanai [Krishna], ferry me across
the river

I will pay you the money I make in
the bazaars of Mathura.

You beautiful Kanai, and your broken
boat.

Where shall I keep the pots of curd,
and where shall I put my feet

Kanai replied, listen O, embodiment
of rasa [savoring/pleasure]

Why did you come to the brimming
river in full monsoon?

First, put your pots of curd in the boat
and then sit in the middle.

Why do you drift in shame in the rain
drops?

I will ferry all *sakhis* [Radha's female
friends] for an anna each.

But for Radhika, I will charge her
gold earrings.¹⁰

Another well-known *saari* song quoted in
Adwaita Mallabharman's novel *Titas Ekti
Nadir Nam* (Titas: The Name of a River),
which was published in 1956, is an expression
of folk romance, where the lover named his
boat Udaytara after the name of his beloved:

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Give him a call, outside the premises,
oh sister, give my closest companion
of heart a call.

My friend expressed his intent to eat
rice... I brought Ghagur fish, oh sister,
I have sent for milk, what pleasure
would I find in rupees and money; oh
sister, give my closest companion of
heart a call.

My friend goes to Dhaka, he prepares
his food on the brink of river, oh
sister, the forces of tide swept away
all the utensils, oh sister, give my
closest companion of heart a call.

My friend knows all the tricks, boat is
anchored in a *haor* [large lake]; oh
sister, the name of the boat was given
Udaytara, what a star, the beauty of
the star stole my heart, oh sister, give
my closest companion of heart a call.

As my friend would come, I did not
bolt the door,

Oh sister, he stole my youth instead of
treasure,

What a theft, a grand theft,

Oh sister give my closest companion
of heart a call.¹¹

Another song from the same novel talks about
the consequences of a secret romantic affair:

Why are you throwing brickbats
when there are no fruits in the mango
tree?

We have not been meeting since long,
then why do you invite me through
your eyes?

We met in a secret rendezvous in the
bur flower plant,

But all the neighbors acted as
enemies as they spread the news in a
jiffy.¹²

Ashutosh Bhattacharya, a linguist
and a historian of the Bengali language and
literature and a collector of Bengali
performing arts, has noted a significant aspect
of these songs:

One must remember that in Eastern Bengal,
the singers [of *saari* songs] are Muslims. It is
only very rarely that a few singers of lower-
caste Hindu origin can be found. Hence, the

songs have been composed and performed by
Muslims. But, the themes in all instances are
that of Radha-Krishna and Nimai
[Chaitanya].¹³

On the other hand, many Sufi poets of Bengal
composed verses in Bengali which relate to
the Radha and Krishna iconography derived
from the Vaishnava tradition.¹⁴ In late
medieval Bengal, 56 sects of Vaishnava
religion emerged in the eighteenth century.¹⁵
The central icons of all these sects were Radha
and Krishna and also Sri Chaitanya. All these
cults were both eclectic and syncretic in
nature. Fakir Aulchand, the founder of
Kartabhaja sect, was himself a Sufi
practitioner. One legend about Aulchand
mentions that he was Chaitanya in disguise.
As the legend goes, disgusted with orthodox
Vaishnavism (Gaudiya Vaishnavism),
Chaitanya took up the garb of a *fakir*.¹⁶ It
should be noted that all of these sects rejected
caste hierarchy, thereby attracting a massive
following amongst the lower orders of
society. Instead of the founding
temples/mosques/shrines, leaders of these
sects established far more intimate contact
with the peasantry. For instance, the elders of
the Kartabhaja sect (Followers of the Karta or
the spiritual master) used to organize
congregations or *baithaks* in the house of a
follower on any chosen evening which would
continue through the night. Different grades
of disciples ensured wider participation.¹⁷

The principal characteristic common to all of
these cults was that they rejected caste system,
and thus, lower-caste people were naturally
attracted to them. Like many other Sufi and
Bhakti sects from medieval India, all of these
Vaishnava sects had a *guru-
shishyaparampara* or master-disciple
tradition. The songs they performed always
had an allegorical significance. The figure of
the helmsman recurs through a number of songs
connected with several of these sects. These
songs can be read as an allegory for the
importance of a teacher or the *guru* in the
followers' lives. Such songs usually depict a
common form of symbolism. The human

body is a frail craft in which the traveler set forth in the stormy river of life, and the senses are drunken ferrymen who would invariably crash the boat on the rocky riverbed of life. One's only hope is the helmsman, or *guru* who, with a steady hand, could lead the boat to its final destination.¹⁸ A few examples of *saari* songs with such underlying symbolism are cited below:

I fear going alone
Come guru, let us cross the river together.
.....
....
First discard the habits of the body
Find a balance between the outside and the inside
Follow the lead of Sujan, the pilot
He will take you on the boat.¹⁹

Another example of a *saari* song that reflects the ambiguous nature of love is quoted below:

Love is a jewel, love is care
Love is a big headache
No matter how hard you try
You can't get rid of it
Just as the bones of *tyangra* fish
Cleave unto human flesh.²⁰

Conclusion - In conclusion, the above songs and its component is a powerful testament to the organic, syncretic fabric of Bengali culture. Originated from the rhythmic labor of the waterways, it unveils rigid theological boundaries by blending Hindu Vaishnava lore, Sufi mysticism, and secular working-class realities into a single musical form. By elevating shared human experience and collective survival over sectarian division, this folk tradition proves that Bengal's cultural identity is fundamentally defined not by separation, but by a deep, flowing harmony.

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Fluorescence Microscopic and Biochemical Investigation on the Biodistribution and Toxicity of Carbon Quantum Dots

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Abstract:

Carbon Quantum Dots (CQDs) are emerging nanomaterials with significant potential in biomedical applications. Information regarding their *in vivo* toxicity remains limited. This study investigated the biodistribution and toxicological effects of CQDs in Swiss albino mice following intravenous administration of a CQD suspension (10 mg/kg body weight) in phosphate-buffered saline (PBS). Biodistribution was assessed through fluorescence microscopy of liver, lungs, spleen, and kidney tissues collected at intervals ranging from 1 to 120 hours after injection. Fluorescence signals were detected in all examined organs, indicating widespread distribution of CQDs. A gradual decrease in fluorescence intensity over time suggested progressive clearance of CQDs from the body. Toxicity studies were conducted by administering CQDs for ten consecutive days and evaluating physiological and biochemical parameters on the 11th and 16th days.

Results showed a temporary reduction in body weight during treatment, which recovered after withdrawal of CQDs. Organ weights of the liver, kidney, and spleen remained unaffected. Biochemical analysis revealed elevated serum alanine aminotransferase (ALT) levels on the 11th day, indicating mild and reversible hepatic stress, while aspartate aminotransferase (AST), creatine, and creatinine levels remained within normal ranges, suggesting the absence of significant liver or kidney damage. Following cessation of treatment, ALT levels returned to normal, demonstrating

recovery of hepatic function.

The findings indicate that CQDs are widely distributed throughout vital organs and are gradually eliminated from the body. Although CQDs may induce slight and temporary hepatotoxic effects, these changes are reversible upon withdrawal. Therefore, CQDs appear to possess a favorable safety profile and hold promise as biological probes and imaging agents in biomedical research.

Keywords: Carbon Quantum Dots (CQDs), biodistribution, nanotoxicology, fluorescence microscopy, hepatotoxicity, nanoparticles, biomedical applications, mice.

Introduction:

Particles with a fundamental dimension within 100 nm have been termed as nanoparticles. These have found use in various fields of Science and Technology. Its use in the field of medicine is a developing area⁽¹⁾. Although quantum dots have extensive use in medicine data on toxicity are scarce. Quite a few instances of *in vitro* cytotoxicity studies with Quantum dots (QDs) has been reported⁽²⁻⁵⁾ but little or very limited attention has been paid to assess their potential toxicity *in vivo*⁽⁶⁻⁸⁾. There are reports⁽⁹⁻¹²⁾ of biodistribution of QDs, information on their *in vivo* toxicity—or the alleged lack of it—has been derived off shoot as of such studies which were not specifically designed to evaluate toxicity. One of the groups has investigated the *in vivo* toxicity of synthesized cadmium selenide/zinc sulfide (CdSe/ZnS) QDs⁽¹³⁻¹⁴⁾, stressing on the pulmonary inflammation and prothrombiceffets. The

existing knowledge on the physiological hazard of QDs is incomplete in comparison to the drugs or other chemical agents⁽¹⁵⁾. Suspension in media and agglomerates of nanoparticles are commonly used for experiments.

As no toxicity study with Carbon Quantum Dots (CQDs) has been documented, the present study has been undertaken to investigate the bio-distribution of the CQDs in mouse model with biochemical parameters detailing outline of the level of toxicity induced by the QDs after intravenous (i.v) injection of suspension of QDs in Phosphate Buffer Saline(PBS). Although other studies suggested the toxicity of carbon nanotubes, to our knowledge, this is the first comprehensive evaluation of the *in vivo* toxicity of CQDs.

Materials and methods:

All chemicals used were of AR grade from Sigma, SD Fine and SRL chemicals, India, and all glass triple distilled water was used throughout. CQD s were of 10 nm diameter, water soluble, procured from Sigma Aldrich. We used male albino Swiss mice supplied from single breed. Standard protocols were followed for biochemical assays⁽¹⁶⁾.

Experiment

Distribution studies:

A suspension of 10 mg/Kg body weight of CQD in Phosphate Buffer Saline was administered i.v in Albino Swiss mice having average body weight of about 12 g were. The CQDS treated animals were then sacrificed after 1 hr, 24 hrs, 48 hrs, 72 hrs, 96hr and 120 hrs of treatment to evaluate the presence of CQDs in the system by fluorescence microscopy. Liver, lungs and spleen were isolated from the animals after sacrifice and were cut into 1-2 mm cubes. The tissues were prepared for fluorescence microscopic studies following standard protocol⁽¹⁴⁾. The slides were then observed under the red and green filter of fluorescence microscope.

Toxicity studies:

Albino Swiss mice were treated with CQDs

for 10 consecutive days same as described above. Animals were then sacrificed on 11th and 16th day respectively and analyzed for toxicity if any.

Physiological and biochemical parameters were noted. The former includes body weight and unit weight of liver, kidney and Spleen expressed as percentage of total body weight. The biochemical studies include serum AST/ALT [aspartate aminotransferase (AST), alanine aminotransferase (ALT)] activities, and blood creatine and creatinine. AST and ALT indicates liver function where as blood creatine and creatinine are nephrological indices.

Results & Discussion:

Distribution studies:

The figures below show fluorescence microscopic pictures indicating the distribution of CQDs in mammalian system after different time span from the time of injection. Figure 1 shows sections of liver, figure 2 those of lungs, figure 3 that of spleen and figure 4 depicts sections of kidney.

As evident from the figures CQDs are present in the system after 120 hrs i.e. 5 days after treatment. But if we compare the pictures (a – f and g-l of each figure), we can see reduced fluorescence intensity with passage of time. This indicates removal of the CQDs from the system.

Toxicity studies:

Table 1 & 2 represent the physiological parameters (average body weight, unit weight of liver kidney spleen expressed as percentage of whole body weight) while table 3 shows the biochemical parameters.

Body weight has been seen to decrease on treatment with CQDs and has increased on stopping the treatment with CQDs (Table 1). The weight of liver kidney and spleen are not adversely affected as the proportion of body weight (Table 2) neither on exposure nor withdrawal of CQD.

The AST values are well within the normal range (99 ± 1.1) but the ALT value of

11th day has increased well above the normal range (43 ± 4.2) (17) not completely ruling out hepatotoxicity, but the 16th day value has decreased and is well within the normal range suggesting temporary malfunctioning of the hepatic cells on treatment with CQDs, which return to normal on withdrawal of the treatment. Blood creatine and creatinine values are well within the normal range ruling out nephrotoxicity.

It has been suggested by others that carbon nano particles and QDs are toxic to physiological system(2-5,15). But our comprehensive studies entail that there occurs temporary malfunctioning of hepatic cells,

which is characterized by elevated level of serum ALT and fall of body weight. The remarkable finding of this study is that the physiological functions return to normalcy on the withdrawal of the CQDs.

Conclusion:

The CQDs⁽¹⁸⁾ being water soluble are widely distributed in vital organs. Although, it induces slight temporary toxicity but its reversal is observed on withdrawal. Moreover, its excretion from the system is also evidenced from the present study. So, the use of CQDs in biological system as probe may become a promising area.

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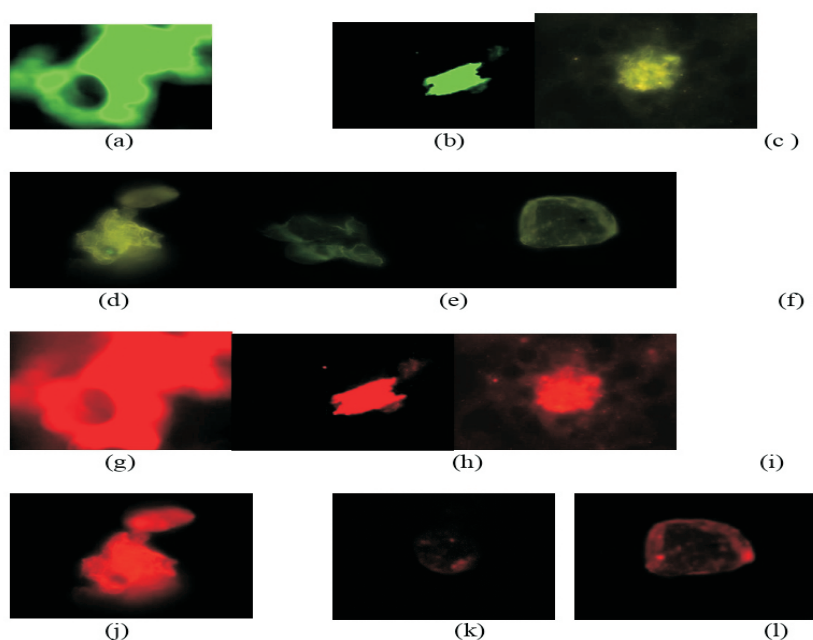
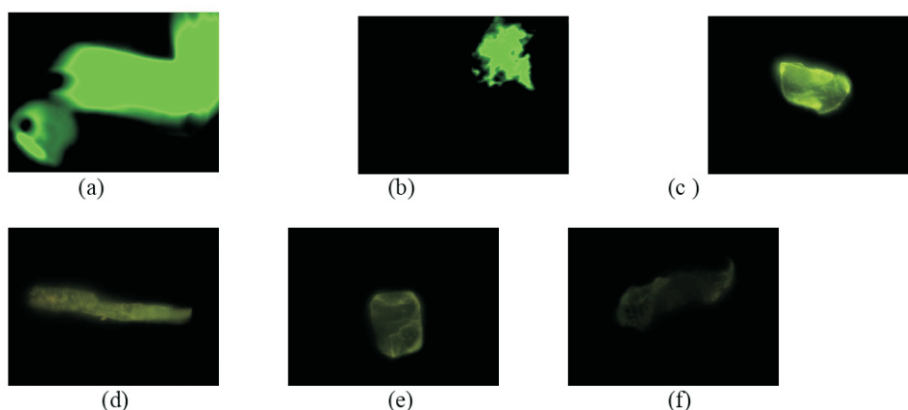


Fig 1: Fluorescence microscopic pictures of histological section of liver under red and green filters.
(a) & (g) : after 1 hr ; (b) & (h) : after 24 hrs; (c) & (i) : after 48 hrs; (d) & (j) : after 72hrs; (e) & (k) : after 96 hrs (f) & (l) : after 120 hrs



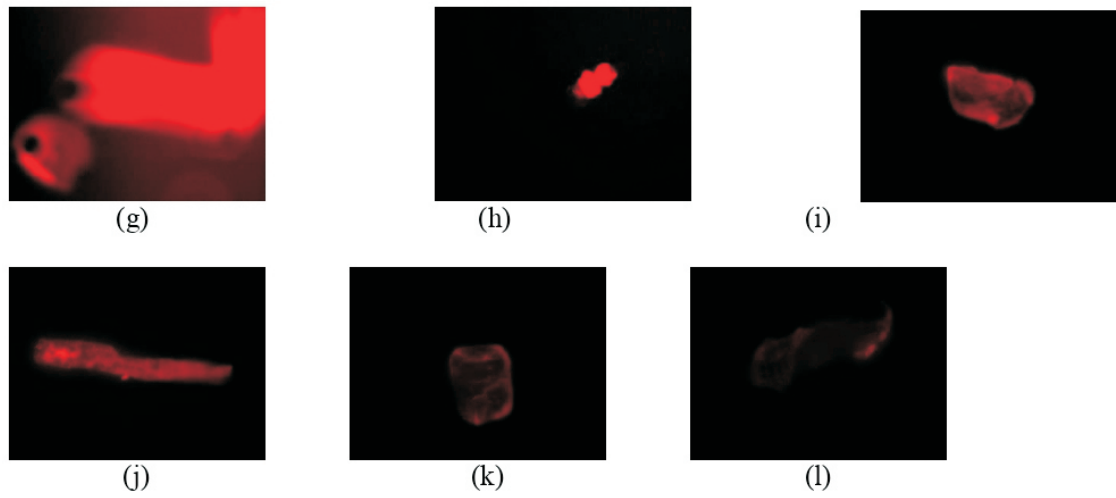
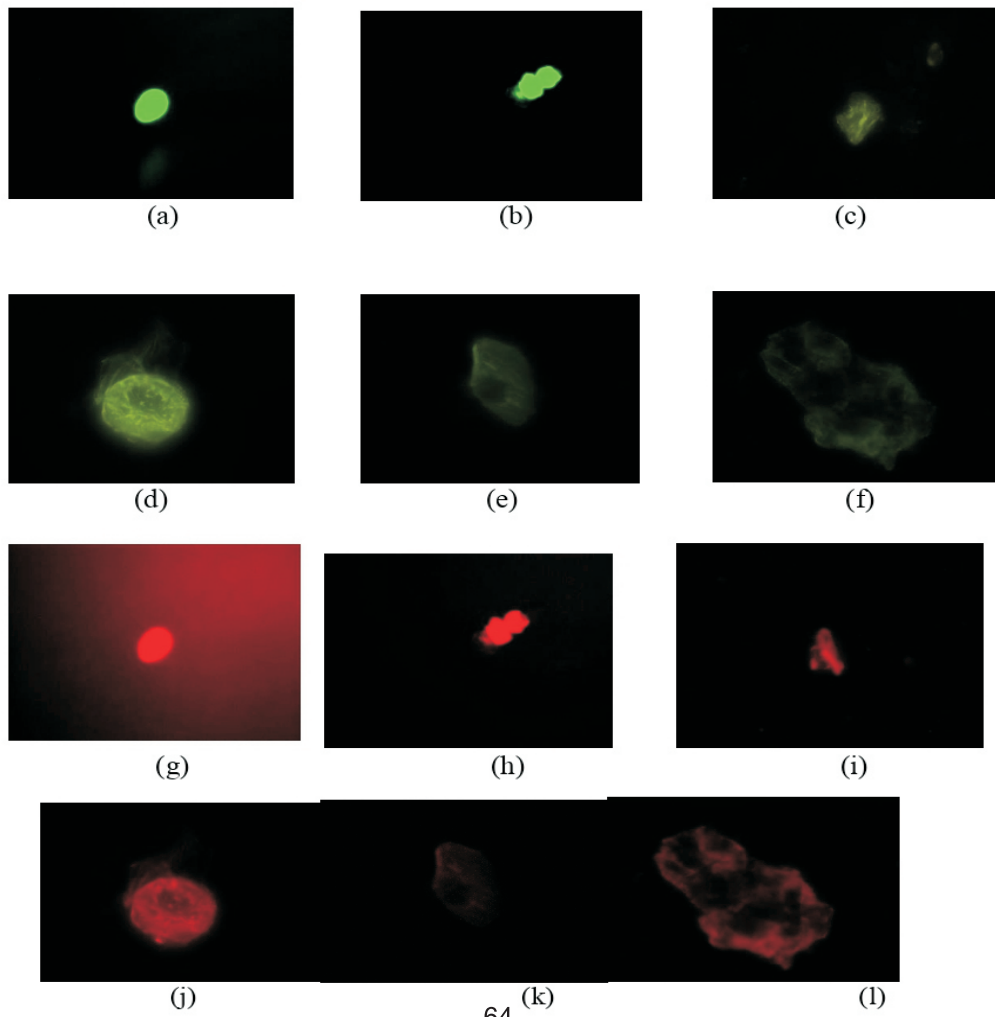


Fig 2: Fluorescence microscopic pictures of histological section of lung under red and green filters.
 (a) & (g) : after 1hr ; (b) & (h) : after 24 hrs; (c) & (i) : after 48 hrs; (d) & (j) : after 72hrs;
 (e) & (k) : after 96 hrs(f) & (l) : after 120 hrs



Fluorescence microscopic and biochemical investigation on the biodistribution and toxicity of Carbon Quantum Dots

Fig 3: Fluorescence microscopic pictures of histological section of spleen under red and green filters.

(a) & (g) : after 1hr ; (b) & (h) : after 24 hrs; (c) & (i) : after 48 hrs; (d) & (j) : after 72hrs;
(e) & (k) : after 96 hrs(f) & (l) : after 120 hrs

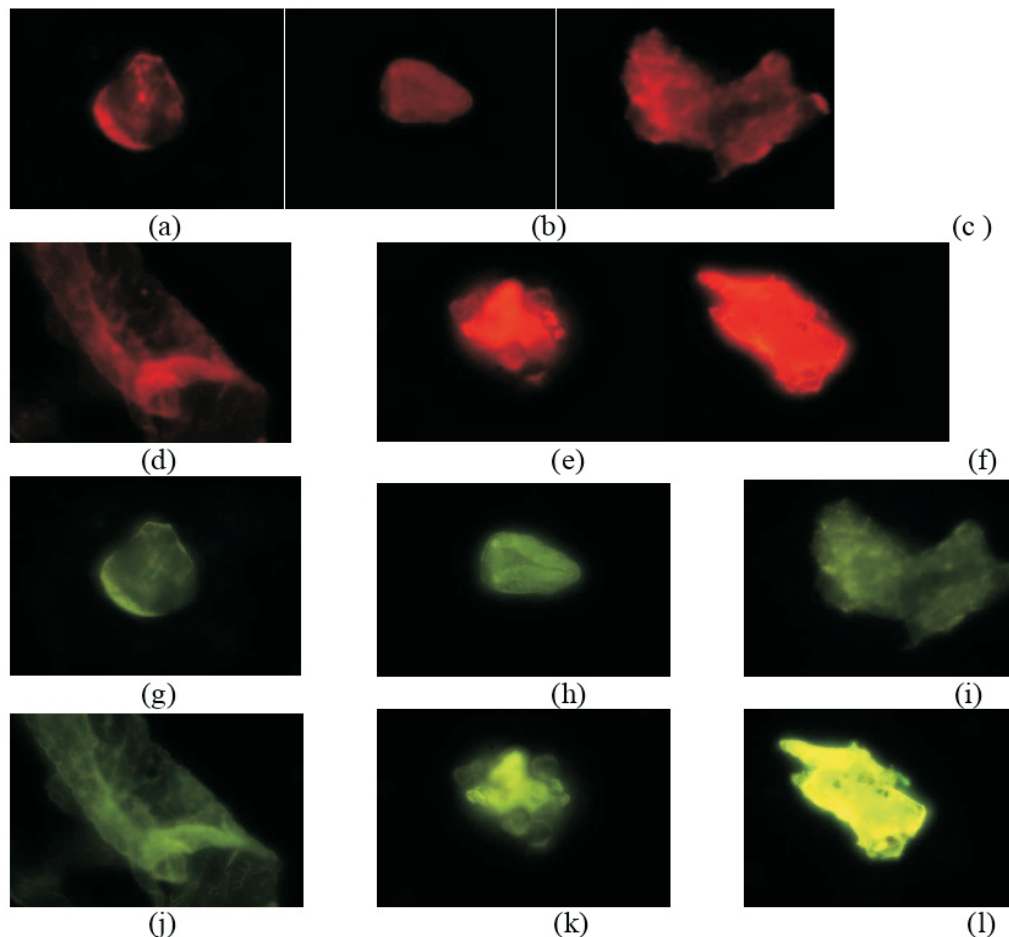


Fig 4: Fluorescence microscopic pictures of histological section of kidney under red and green filters.

(a) & (g) : after 1hr ; (b) & (h) : after 24 hrs; (c) & (i) : after 48 hrs; (d) & (j) : after 72hrs; (e) & (k) : after 96 hrs (f) & (l) : after 120 hrs

Table 1: Average body weight expressed in g

Time	Body weight
Initial	11.6 ± 1.19
11 th day	9.5 ± 1.5
16 th day	12.9 ± 2.5

Data represented as value $\pm$ S.D.; n = 3

Table 2: Weight of liver, kidney and spleen expressed as percentage of total body weight of animals

Time	Liver	Kidney	Spleen
11 th day	4.6 ± 0.005	1 ± 0.0	0.3 ± 0.0
16 th day	5.6 ± 0.005	1 ± 0.0	0.3 ± 0.0

Data represented as value ± S.D.; n = 3

Table 3: Serum AST & ALT, Blood Creatine& Creatinine values:

Time	AST	ALT	Creatine	Creatinine
11 th day	36.99	53.33	1.07	0.53
16 th day	29.26	38.39	1.08	0.31

Values expressed as International Unit (I.U)

The Moral Ambiguity of Traumatic Survival: A Medical Humanities Study of Miklos Nyiszli's "Auschwitz: A Doctor's Eyewitness Account"

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Abstract: Dr. Miklos Nyiszli's memoir, *Auschwitz: A Doctor's Eyewitness Account*, exposes the profound moral ambiguity of a Jewish doctor forced to assist Dr. Josef Mengele's horrific medical experiments. Operating within the crematoria, Nyiszli's survival relied entirely on his professional status. This paper utilizes a medical humanities lens to explore his narrative, examining how he weaponized Michel Foucault's concept of the "medical gaze" as a clinical shield against overwhelming horror. While critics like Bruno Bettelheim condemn Nyiszli as an accessory to SS atrocities, this study reframes his actions through Primo Levi's framework of the "grey zone" and Lawrence L. Langer's "choiceless choices." It argues that standard moral metrics fail to capture the reality of an environment designed to force complicity and further asks whether any post-war ethical vocabulary can legitimately adjudicate conduct produced under such conditions. The paper also situates Nyiszli's testimony among comparable Holocaust medical narratives, addresses critical bioethical dilemmas regarding the modern utility of Nazi medical data, alongside Cathy Caruth's trauma theory, which views the text as a post-traumatic attempt to negotiate survivor's guilt. Ultimately, by refusing to offer a sentimentalized redemptive arc, Nyiszli's testimony aligns with Matthew Boswell's "Holocaust impieties" and Theodor W. Adorno's negative dialectics, forcing an unsettling confrontation with the limits of human morality and judgment.

Keywords: Bioethics, grey zone, Holocaust, medical humanities, narrative medicine, trauma.

Introduction

The Holocaust was a massive turning point in history that completely tore apart the basic foundations of Western ethics, science, and philosophy. The intersection of medicine, ethics, and literature during the Holocaust challenges the very foundations of Western humanism. Within this catastrophic landscape, the memoir *Auschwitz: A Doctor's Eyewitness Account* by Dr. Miklos Nyiszli provides a chilling account from the epicentre of the extermination machinery. Dr. Nyiszli, a Hungarian Jewish physician, survived the Holocaust by functioning as the chief pathologist for the infamous Dr. Josef Mengele who was called the "Angel of Death" at the Auschwitz crematoria. The book works as a piece of 'narrative medicine'—a story that shows us sickness, trauma, and survival from the point of view of a doctor who had to compromise his own ethics to stay alive. This coercion did not occur in a historical vacuum. The Nazis established death camps across occupied Europe to carry out the systematic extermination of Jews and other groups they targeted. These camps were central to the regime's racist ideology, which claimed the supposed superiority of the "Aryan" race. Auschwitz-Birkenau became the largest and most notorious of these camps: between 1942 and 1944 about 1 million Jews were murdered there, many in gas chambers. This mass murder was part of the Nazi policy known as

the “Final Solution to the Jewish Question,” the planned, bureaucratic effort to annihilate the European Jews. The camp's design—selection ramps, crematoria, and the use of prisoners to do brutal tasks—was part of that system. It is only within this engineered environment, built expressly to manufacture complicity among its victims, that Nyiszli's dilemma as an inmate-doctor can be properly understood. His memoir does not simply document individual suffering; it reveals how the machinery of anti-Semitism could co-opt even those it meant to destroy. From the very beginning of his memoir, Nyiszli establishes the clinical framework through which he processes his trauma: “When I lived through these horrors, which were beyond all imagining, I was not a writer but a doctor. Today, in telling about them, I write not as a reporter but as a doctor” (Nyiszli, 1993, p. 35). Nyiszli's memoir embodies the profound ethical ambiguities of the Holocaust. He operated within what Primo Levi terms the “grey zone”—a liminal space of moral ambiguity where the binary categories of victim and perpetrator dissolve under the weight of systemic complicity (Levi, 1988). He oscillates between the unbearable reality of mass murder and the equally painful struggle to live with the guilt of survival.

Literature Review

Scholarship on Holocaust medical testimony has tended to situate doctor-memoirs within one of two groups. The first, exemplified by Robert Jay Lifton's *The Nazi Doctors: Medical Killing and the Psychology of Genocide* (1986), approaches the subject primarily through the psychology and moral collapse of the perpetrators—physicians such as Mengele who used medicine as an instrument of murder. The second tradition, informed by Primo Levi's own testimony in *Survival in Auschwitz* and *The Drowned and the Saved* (1988), and by Giorgio Agamben's philosophical account of witnessing in *Remnants of Auschwitz* (1999), focuses instead on the prisoner's experience of coerced complicity—what Levi terms the

grey zone. Nyiszli's memoir sits uneasily between these two traditions: he was neither an SS physician nor an ordinary prisoner, he was a prisoner forced to become a cog in the horrific machine of Mengele's experiments, a painful middle ground that existing scholarship has mostly overlooked. Critical attention to Nyiszli has been limited to Bruno Bettelheim's hostile foreword and passing comparisons to Elie Wiesel's *Night* (1960) or Levi's writings to show the horrors of forced labour, rather than analyzing his specific medical experience. This study bridges that gap by analyzing Nyiszli's testimony through Michel Foucault's ideas on medical power, Levi and Lawrence Langer's ethical frameworks, and Cathy Caruth's trauma theory, treating his memoir as a rare example of a healer processing the absolute worst of humanity and medicine.

Methodology

For the present study Descriptive Qualitative Research Method is applied. This paper uses an interdisciplinary approach within the medical humanities to analyze Dr. Miklos Nyiszli's memoir, *Auschwitz: A Doctor's Eyewitness Account*. Rather than viewing the text as a simple historical record, I treat it as a complex piece of trauma literature and narrative medicine. In addition to the primary text, this study relies on secondary critical literature—including foundational works in trauma theory, bioethics, and Holocaust studies—and situates Nyiszli's account in comparative relation to other Holocaust medical testimonies discussed in the Literature Review, in order to provide the theoretical and comparative framework necessary for the analysis.

Discussion

The Medical Gaze as Clinical Shield

During the Holocaust, the normal goal of medicine—to heal people—was totally twisted, turning doctors into cogs in a massive killing machine. Under the Nazi regime, medicine was turned into a cold, clinical tool for mass murder. To understand how an inmate doctor could perform hundreds of autopsies on his fellow prisoners to aid an SS

war criminal, one must look to Michel Foucault's concept of the "medical gaze" (*Le Regard Medical*, Foucault, 1963/1973). Foucault posits that modern clinical medicine operates by separating the patient's subjective identity from the physical body, reducing the individual to a site of anatomical inspection and pathological classification. The brutal reality of Auschwitz forced that medical detachment to a horrifying extreme. Nyiszli's narrative relies heavily on this structured medical lens as a psychological shield.

Nyiszli's memoir is permeated by this clinical detachment, which serves both as a survival mechanism and a source of profound ethical subversion. He sums up the ambiguity of his professional position early in his memoir: "As chief physician of the Auschwitz crematoriums, I drafted numerous affidavits of dissection and forensic medicine findings which I signed with my own tattoo number" (Nyiszli, 1993, p. 11). The image of a medical affidavit signed with a prisoner's tattoo number perfectly summarizes the collapse of ethical boundaries; the physician is simultaneously an authority figure and a dehumanized captive. Entrapped by the Nazi medical apparatus, Nyiszli admits his horrifying compliance, writing, "I planned to carry out [Mengele's] orders to the best of my ability" (Nyiszli, 1993, p. 41). Forced into this nightmare, Nyiszli dissected hundreds of bodies "so that a science based on false theories might benefit from the deaths of those millions of victims" (Nyiszli, 1993, p. 305). To cope with the horror, he psychologically tried to justify his work by believing it could serve a higher medical purpose. In *Ethics During and After the Holocaust*, John K. Roth argues that the Holocaust did not merely pronounce the death of ethics, but rather proved that ethics are immensely vulnerable to misuse and perversion as demonstrated by the Nazis' capacity to subvert medical science to serve mass murder disguised as racial purity. Nyiszli's forced participation highlights the terrifying reality that medical ethics offer no absolute protection against totalitarian subversion. The facts gathered from these horrific experiments still cause

fierce debates in the medical world today. It forces us to confront a really difficult bioethical dilemma. At its core, this debate asks if any scientific breakthrough is worth validating the horrors of Auschwitz.

The Grey Zone and Choiceless Choice

It reveals that Nyiszli's clinical detachment wasn't just a survival tool—it was a way to trick his own conscience. In his fiercely critical foreword to the memoir's English translation, Bruno Bettelheim completely rips into Nyiszli for hiding behind his medical title. He argues that being a doctor didn't change the facts: Nyiszli was still an accessory to the horrific crimes of the Nazi regime. Bettelheim insists that Nyiszli spent his entire survival playing a mental trick on himself. He explicitly points out "how Dr. Nyiszli fooled himself... in his repeatedly referring to his work as a doctor, though he worked as the assistant of a vicious criminal" (Bettelheim, 1993, p. 21). The ethical crisis at the heart of Nyiszli's memoir cannot be adequately addressed through standard moral frameworks. Instead, it demands an engagement with Primo Levi's concept of the "grey zone" (Levi, 1988). In *The Drowned and the Saved*, Levi identifies this zone as a space inhabited by "privileged" prisoners—such as the "Sonderkommando" (the special work units in the gas chambers and crematoria)—who were forced to collaborate with their executioners in exchange for a temporary deferral of execution. Nyiszli, by virtue of living and working within Crematorium II, was an elite member of this tragic contingent.

Condemning Nyiszli for sacrificing his medical ethics to survive is an oversimplification of an agonizingly complex reality. Such blanket condemnation reeks of "sentimental naivete" and an "assumed moral superiority" from those who have never known the camp system. As philosopher John Roth emphasizes in his ethical assessments of the Holocaust, the Nazi regime systematically manufactured situations bereft of ordinary moral options, forcing victims into what Lawrence L. Langer famously designated

"choiceless choices"(Langer, 1991). These are situations where choices are made not between good and evil, but between two forms of intolerable degradation or death. Nyiszli's repeated insistence that he "planned to carry out [Mengele's] orders to the best of my ability" (Nyiszli, 1993, p. 41) is, on this reading, not evidence of enthusiasm but of a will bent entirely toward the sole remaining objective available to him: continued survival. To evaluate Dr. Nyiszli's actions with any real accuracy, we have to listen to Susan Pentlin's crucial reminder about Holocaust history. She argues that if we want to truly comprehend how completely the Nazis shattered traditional human ethics, we must force ourselves to listen to the complicated, messy "voices from the grey zones" (Pentlin, 2005). We have to accept that these prisoners were trapped in an engineered nightmare. Their survival tactics and agonizing decisions were entirely warped by a brutal environment that was completely beyond their control, meaning our standard rules of right and wrong simply do not apply to them.

War, Morality, and the Limits of Post-War Ethical Frameworks

This brings up a much deeper issue: whether moral ideas invented long after the events happened—like Primo Levi's "grey zone," Lawrence Langer's "choiceless choices," or modern bioethics—can fairly judge actions that took place when everyday morality was completely wiped out. Total war, and the camp system at its absolute worst, does not just make it difficult to do the right thing. It completely rewrites the meaning of words like consent, complicity, and guilt. Judging Miklos Nyiszli by comfortable peacetime standards imposes a safe, backward-looking bias on a horrific reality. On the flip side, refusing to judge him at all risks erasing the thin line between actual collaboration and desperate resistance. Levi's grey zone tries to balance both of these uncomfortable realities—not as a neat, perfect solution, but as an intentionally uneasy compromise. Because Nyiszli's testimony never asks for

forgiveness or offers a standard confession of guilt, it stands as a major test case. It forces us to examine exactly where our traditional moral rules stop working when they follow a healer into an extreme environment like Auschwitz.

Trauma, Testimony, and Narrative Medicine

Nyiszli's memoir is not merely a historical record; it is a desperate attempt to process the profound psychological trauma of his experiences. In *Unclaimed Experience: Trauma, Narrative, and History*, Cathy Caruth (1996) posits that trauma is not simply an effect of destruction, but fundamentally an "enigma of survival." The traumatized individual is haunted not only by the incomprehensibility of near-death, but by the very incomprehensibility of having survived when so many others perished. For Nyiszli, the act of bearing witness is an oscillation between what Caruth identifies as "the story of the unbearable nature of an event and the story of the unbearable nature of its survival"(Caruth, 1996, p. 7). This psychological burden is compounded by survivor's guilt. Nyiszli's text is saturated with the underlying resonance of guilt from which he cannot escape, driving his compulsion to write. Even after successfully avoiding the gas chambers, the psychological toll of his survival inside the grey zone left him utterly desolate. Reflecting on his miraculous evasion of death, he confesses: "the fact that I had come away with my life gave me neither comfort nor joy" (Nyiszli, 1993, p. 161). In the context of medical humanities, his text functions as a form of "narrative medicine," allowing him to narrate the "illness" of the Holocaust from a physician's perspective, thereby engaging the reader in an emphatic, yet horrified, understanding. By "speaking the unspeakable," Dr. Nyiszli attempts to make sense of his post-traumatic stress. He uses his testimony to speak for the thousands of voiceless victims whose bodies he had to dissect.

Holocaust Impieties and Negative Dialectics

Trying to write about what happened inside

the Auschwitz crematoria brings up massive philosophical and moral problems. In *Negative Dialectics*, Theodor W. Adorno (1973) famously expanded his critique of culture after World War II, arguing that writing poetry after Auschwitz is an act of barbarism. He believed that the systematic slaughter of millions completely shattered Western culture's claim to any real moral or philosophical progress. Adorno's philosophy of negative dialectics basically demands that we look directly at historical horrors without trying to find a silver lining. For Adorno, modern thinkers can't just look away from our worst historical failures. We have to confront them head-on, and try not to sanitize, excuse, or varnish the horrors of the Holocaust. Dr. Nyiszli's memoir provides exactly the kind of unvarnished, painful testimony that Adorno demanded. It offers absolutely no narrative reconciliation, no happy endings, and no sense of moral redemption. Nyiszli refuses to sanitize his time in the crematoria; instead, he leaves the reader sitting face-to-face with the gritty, terrifying mechanics of industrial mass murder. By refusing to turn his survival into a comforting lesson about the resilience of the human spirit, his book forces us to sit with the pure, unresolved shock of what human beings are capable of doing to one another.

This lack of aesthetic sanitization aligns directly with Matthew Boswell's (2011) framework of "Holocaust impieties" in literature. For Boswell, testimonies that are shocking or deeply disturbing serve a vital purpose: they break through the safe, sanitized ways we usually try to remember history, forcing us to look directly at the raw horror of genocide. Nyiszli's memoir is profoundly "impious" in this regard. His book completely avoids the classic survival story trope where everything is neatly tied up at the end with an inspiring message about the human spirit. Instead, it forces the reader to confront the visceral reality of a Jewish doctor working in a state-of-the-art laboratory alongside Nazi executioners, handling organs, and meticulously preparing specimens harvested from murdered twins. By refusing to soften these details, Nyiszli's

text satisfies Adorno's demand that art and testimony must register the shock of the Holocaust without turning it into a tidy, digestible moral lesson.

The Bioethical Legacy of Nazi Medical Data

From the bioethical point of view Nyiszli's memoir posits a dilemma regarding the legacy of the data collected during the horrific medical experimentations during the Holocaust. The narrative forces a critical question onto modern medicine: how can bioethics maintain its integrity when confronted with data generated under circumstances where all human morality was completely suspended. Some ethicists argue that if data or anatomical findings recorded by doctors like Nyiszli can save human lives today, it should be utilized, thereby extracting a modicum of good from an abyss of evil. However, a more rigorous ethical stance suggests that utilizing data harvested from the Nazi experience acts as an unacceptable compromise. In a place completely stripped of humanity and morality, trying to use normal medical ethics just feels pointless. The main bioethical lesson from Nyiszli's story isn't about whether he broke the Hippocratic oath just to stay alive. Instead, it forces us to take a hard line: any medical data stolen through the torture and murder of camp prisoners must be completely banned from future scientific use. Using that research doesn't honour the dead; it risks legitimizing the original crimes and builds our modern scientific progress right on top of the horrors of Auschwitz.

Conclusion

Dr. Miklos Nyiszli's *Auschwitz: A Doctor's Eyewitness Account* is still one of the most unsettling texts in the medical humanities. It shows how easily professional ethics can shatter under the absolute pressure of a death camp. When we look at his story through Foucault's clinical gaze, Levi's grey zone, and Caruth's trauma theory, we see that Nyiszli was neither a simple collaborator nor a perfect hero. He was a complicated victim whose medical training was both his only way to survive and his lifelong psychological prison.

As the preceding discussion of post-war moral frameworks suggests, no single ethical vocabulary fully resolves the case; Nyiszli's testimony instead demonstrates the limits of applying peacetime moral categories to conditions engineered to abolish them. Ultimately, his clinical, harrowing testimony makes a vital contribution to Holocaust literature by refusing to sanitize the horror. It honours Adorno's demand that we face historical atrocities head-on, forcing us to confront human complicity, the limits of our own moral judgment, and the deep trauma a doctor carries after witnessing the crematoria. His raw narrative is a permanent challenge to modern bioethics, warning us that when medicine loses its humanity, it quickly turns from a practice of healing into a highly efficient machine for mass murder.

Nyiszli's agonizing dilemma does more than just record history; it provides a

direct parallel to the impossible ethical traps medical workers still navigate today. These modern pressures include doctors forced into military or paramilitary roles, and healthcare staff compelled to ration life-saving care under ruthless regimes or during a total collapse of resources. Furthermore, it highlights the ongoing struggle over whether to utilize medical data and techniques originally obtained through cruel or deeply unethical research. By taking the ideas of the "grey zone" and "choiceless choices" and applying them to the modern world, future researchers can see if the words of Primo Levi and Lawrence Langer—which were born out of the horrors of Auschwitz—can really help us understand the agonizing choices doctors face under pressure today. Ultimately, as this paper suggests, each new nightmare of forced compliance may demand its own entirely new way of defining right and wrong.

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